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NOTE. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

The Editor's notes are marked (*Ed.*); the letter *R.* indicates the references to the foregoing issues (Monthly and Quarterly) of the International Review.

ORIGINAL ARTICLES

THE FERTILITY OF EGYPT.

I. The principal factors of the agricultural wealth of Egypt.

The *annual national revenue* of Egypt is estimated at approximately 300 million Egyptian pounds.

The total revenue of landed property, which at present has an area of scarcely two and a quarter million hectares under cultivation, amounts to 148 million Egyptian pounds, of which 108 million represent approximately the *value of the annual crops*. The wealth of Egypt is therefore considerable and agriculture is the principal source (1) (2) (3).

Of the natural and artificial factors of this wealth, will be mentioned only the more important of those which are directly connected with the production of the soil:— *the geographical position, climate, rural manual labour*, and lastly the *soil* and the *river* which waters it.

The geographical position influences *commerce* and the *flora*. Situated at the junction of two seas, on the banks of a great river, at the meeting point and on the maritime route of three continents, Egypt has always been a centre of international trade. However, until about a hundred years ago, transport held precedence over real exportation, but the introduction of the cultivation of cotton and sugar-cane has reversed this relation (4). Agricultural produce

constitutes almost the whole of the exports of which cotton alone represents 84 % (5). Owing to its geographical position this country has a great advantage as regards the transport of this rather bulky textile. The history of the commerce of Egypt shows that a strong, far-seeing Government has always been one of the essential conditions of her prosperity.

The influence that the geographical factors, assisted by climatic conditions, have exercised on the *flora*, both wild and cultivated, has been considerable. Owing to her numerous connections, Egypt has, in the course of years, tripled the number of plants which were formerly cultivated (6) (6'). This number now amounts to about 150. The very interesting story of these acquisitions is not only the history of Egyptian agriculture but also that of her external relations, the story of which has been related elsewhere (7). Experiments of acclimatization date from very ancient times They have been carried out to such an extent that it is difficult now to add to the number (8).

The *climate* of Egypt has great advantages It is generally fairly uniform and free from extremes There is no excessive heat or very dry weather during the warm season, which favours the production of fine cottons and maize in the Delta and it is not too cold in winter, which allows " bersim " (*Trifolium alexandrinum*) to be grown throughout the country. Although uniform, the climate shows sufficient differences between the south and north to require from the farmer some discretion in the choice not only of the species, but also of the varieties grown, which accounts for the following geographical disposition of crops :— cotton, flax, sugar-cane, maize, millet, beans, barley, " bersim, " lucerne, fenugreek, lupins, chick-peas, vetch, tares, lentils, onions, sesamum, ground-nuts, henna, melons and water-melons, grow in all parts of the country. The fine cottons are however special to Lower Egypt. Upper and Middle Egypt are preeminently the regions for the sugar industry, and also of millet, onions, lentils, vetch, tares, lupins, chick-peas and beans. The poppy, safflower and indigo, now neglected, used to be especially important crops in these areas.

Maize, ground-nuts, sesamum and henna are grown more in Lower Egypt.

Rice, " dinébé " and " samar " are crops confined to the north of Lower Egypt and the Fayoum (7).

In the distribution of crops the varied nature of the soil also has an important, and sometimes a dominating influence (9).

Native labour is abundant and satisfactory and forms a powerful factor in the prosperity of agriculture and, consequently, of the wealth of Egypt. The "fellah", of whom both savants and travellers have spoken highly, adds to strength, activity and endurance, a traditional experience, and a profound love for the soil. This instinct, the extraordinary fecundity of the race and the fact that cultivable land is scarce, and bounded by the sea and the desert which hinder emigration and assure to agriculture, in spite of a very high infantile mortality, an inexhaustible supply of manual labour, safeguard Egypt from that social evil, the exodus of the rural population to the towns (4).

The soil and the Nile. — Throughout the centuries the fertility of the Nile valley has caused universal admiration. The arable land in Egypt is the gift of the river, and is very largely formed of mud brought down by the Blue Nile and the Atbara.

The Egyptian soil owes its fertility especially to :—

(1) *The very varied mineralogical composition.* The original rocks from which the soil is formed are principally volcanic, and eruptive, crystalline and sedimentary, and to these has been added very valuable transported material.

(2) *The extreme tenuity of its constituent elements.* Egyptian soils contain from 35 to 80 % or more of clay, of which sometimes more than 8 % is colloidal clay. Owing to this tenuity its elements offer a very large surface to the action of dissolving agents and impart to the soil particles a great absorptive power, which fortunately corrects the action of certain injurious salts (notably alkaline carbonates).

They thus acquire great importance in the cracking of the ground which, as will be shown, contributes to the maintainance of the great fertility of the soils of this country.

(3) the conditions of moisture and climate which, as has been shown, are very favourable.

(4) *The presence of certain salts* (especially calcium salts), which are important from the point of view of chemical, physical and biological factors.

Analyses and manuring experiments confirm the richness of Egyptian soil in fertilizing elements, ***except in nitrogen*** (10) (11) (12) (13).

Without the Nile, however, this land would only be an arid desert. The Nile is distinguished for its remarkably regularity of conditions and by the relative slowness of its flow. A rather sluggish river, it deposits, long before reaching Egypt, all coarser sediment, bringing there only the finest elements (14).

Fortunately, during the greater part of the year, the water contains in solution more calcium and magnesium than sodium and potassium, which prevents the land which it waters from becoming alkaline, compact, impermeable and more or less unproductive (10).

Another advantage which the Nile has for agriculture is the relatively high temperature of the water (8).

Lastly, the Nile not only waters the crops but constantly fertilizes with mud the valley which it has formed (10).

II. The principal conditions of the maintenance of the fertility of the Egyptian soil.

After having thus reviewed the principal factors of the agricultural wealth of Egypt, the essential conditions may be discussed which assure to the soil of that country the maintenance of its great fertility (10).

During many thousands of years Egypt has practised under the ancient system of basins, a method of cultivation similar to the "dry farming" of the present day.

The ground was not tilled, the surface was only slightly disturbed for some crops; it was not manured and although produce of the same kind was taken every two years, the soil yielded fairly regular crops.

This regularity which has frequently been commented upon, was, in our opinion, especially due to a favourable combination of circumstances which assisted production and *made the best use of a scientific rotation of crops*. The whole formed an efficient system, every detail of which was scientifically justified. The system was practised with plants adapted by several centuries of natural selection, to the conditions of the environment; the method of cultivation was both simple and economical; there was no fear of scarcity of water or manual labour, or of live stock or implements. Under the climate of this country frosts and bad weather are alike rare during the winter. No anxiety was feel as regards drainage

or the level of the water table. No special or costly arrangements were necessary for the regulation of irrigation water.

A stratum of naturally-rich alluvium was worked, which was annually drained, renewed, and in addition enriched by the fertilizing water of a river with remarkably regular conditions. The land, in the great majority of cases, was only cultivated in winter. In the rotation of crops, cereal or the industrial plants alternated with leguminous plants. After the winter crop, the land was left fallow, exposed to the heat and drought until the following high Nile. This long period of dry fallow is known as the " charaqi " period.

The leguminous-cereal rotation, used with great judgement, has contributed very much to the productivity of the soil and the constancy of its yield The leguminous plants derive from the air the nitrogen necessary for the cereals and industrial plants, thus providing against the relative poverty of the soil in this indispensable element. This part has been played for nearly 14 centuries by the valuable " bersim ". Imported in the VIth century from the Balkan peninsula, " bersim " is not only a valuable forage plant, but also a weed-destroyer and very useful as regards freeing land from salt, or in connection with the permanent drainage of land There are few other plants which are so important in local agriculture.

The soil lies fallow after the winter crops and under the combined action of the heat and drought during a long period, undergoes considerable contraction which causes it to crack in every direction. This cracking, as has been proved long age, is one of the most effective causes of the maintenance of the fertility of the Egyptian soil under the old basin system (20) of cultivation.

The principal factors which contribute to the desiccation and cracking of Egyptian soil are :— the temperature of the soil (from 55° to 70°C. and over), evaporation (from 2.5 mm. in the north, to 13.5 mm. at Assouan), the level of the underground water-table and lastly the nature of the soil.

The linear contraction of a soil subject to desiccation is controlled on one hand by the degree of dispersion of the soil particles and on the other by the degree of aggregation of these particles. With more colloidal clay there will be less aggregation and the greater will be the contraction in volume during desiccation (10). It has been shown elsewhere that the quantity of colloidal clay in the

Nilotic deposits expressed as a percentage of dry soil, varies from 1.75 for sandy alluviums to 8.65 for clayey alluviums (11). Contraction varies between 30 and 45 % in volume according to the soil. There has been recorded, during the " charaqi " period in land, near Cairo, a subsidence of 8 cm. followed by an approximately equal rising during the growth of " bersim ". The cracks attain a depth of 0.25 m. to 1.5 m. and more. The width of the cracks at the surface often exceeds 10 cm. The total volume of the empty spaces is often more than 50 % in the south of the Delta It is still higher in Middle and Upper Egypt (10) (15).

Owing to the combined action of heat and desiccation, the benefits of the " charaqi " period are many. There is first of all a very important result caused by the cracks in the permanent freeing of land in the Nile valley from salt. The epipolhydric function being more important than the bathydric function, especially in northern regions, and the cracked soils behaving from this point of view like permeable rocks on a large scale, where the cracks play the part of pores, it is evident how useful these cracks were for the permanent drainage of Egypt during the many centuries through which the basin system lasted (10) (15) (16) (17) (18) (19). But the " charaqi " period has other not less valuable advantages. It modifies in a very favourable manner the physical, chemical and biological properties of the soil (10) (20)

The cracks introduce air to considerable depths in the soil, where it is distributed in an infinite number of increasingly small ramifications, until the capillary spaces are reached. In this way the air is distributed throughout the whole mass The aeration thus produced, in depth alone, would be difficult to attain with the best implements. On the other hand, the mellowing of the soil allows of a greater absorption of water and in a short time a comparatively uniform distribution of moisture at all levels, results.

The heat and desiccation of the " charaqi " season, by their action on colloidal matter, contribute largely to the maturing of recent deposits of Nile clay of a certain thickness, which are uncultivable the first year.

Thus the " charaqi " period improves the physical properties of the soil and notably its permeability, porosity and capacity for air and moisture (10).

As regards chemical properties, the phenomena of oxidation, which maintain the soil in a normal condition, should first be noted.

Next, the transformation into bicarbonates of alkaline carbonates which are frequently formed in the sub-soil of low, clayey, badly aërated soils.

Moreover, the cracks enable atmospheric agents to act with ease and intensity on the mineral constituents of the soil. Lastly, under the action of heat and desiccation the colloids, which coat the minerals in the soil and cement the soil particles, become dehydrated, contract, crack or crumble to dust, and the soil after each " charaqi " period, is to a certain extent renewed and regenerated (10).

From a biological point of view, the " charaqi " period exercises an effect similar to that of a partial sterilization (21) (22) and causes an " awakening of the soil " after the following high Nile (10).

During the fallow period, the nitrogenous organic matter, elaborated by the leguminous plants of the rotation, remains more or less intact in the soil. But as soon as the flood water abates, owing to the partial sterilization which the soil has undergone during the " charaqi " period, nitrification of this organic matter takes place actively, for the greater benefit of the cereals which succeed the leguminous plants. The " charaqi " period has the effect, in short, of putting the soil in a condition to produce, at a given moment and in sufficient quantity, directly assimilable nitrogen, an element the great importance of which in Egyptian agriculture has been shown (10).

The heat and desiccation destroy also the germs of most of the pests, animal and vegetable, of the cultivated plants (10).

After the long " charaqi " period, the basins became refilled during the flood of " red water ", which remained there for 50 to 70 days. They emptied themselves into the bed of the river or into lakes on the borders of the Mediterranean before the sowing of the winter crops, that is to say towards the end of October or the beginning of November, according to the district. Each hectare received about 13 500 cubic metres of water, of which it absorbed approximately 10 000 and which enriched the land by depositing more than 15 tons of mud per hectare (10). During the inundation, bacteriological activity is small, there is complete arrest of nitrification and accumulation of ammonia (21). But as soon as the water falls, the conditions again become aerobic, nitrification takes place vigorously, ammonia disappears and the effects of the

partial sterilization immediately make themselves felt to the great benefit of the newly sown crops (10)

In the course of the early part of the XIXth Century irrigation by basins was suppressed, in the Delta and in the Fayoum, to give place to perennial irrigation In Middle Egypt, the convertion of part of the basins was not carried out until the beginning of the XXth Century, consequent on the construction of the Assouan reservoir. That substitution has modified considerably the conditions of production

A progressive decrease is observed in the yields of certain crops during the last twenty years and the growing anxiety which it causes contrasts singularly with the views generally held in former times

However it has been shown elsewhere that :—

(1) this decease is due mainly to unscientific management of the soil and to ill-advised practices which have arisen from the excessive expansion of cotton-growing ,

(2) the causes which determine it do not affect the fercility itself of the soil in a permanent manner ,

(3) the return to the triennial rotation of scarcely twenty-five years ago, coupled with the already common use of suitable manures, as well as the still uncommon use of selected seed, would suffice to arrest this regression (10)

For this reason we believe that Egypt can still look forward with all confidence to a future which, under the aegis of an enlightened Sovereign, holds out the surest promises of prosperity

VICTOR M. MOSSÉRI,

Technical Adviser and Director of Agricultural Research of the Royal Society of Agriculture of Egypt, Former President of the Institute of Egypt, Correspondent of the Academy of Agriculture of France, etc

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THE CULTIVATION OF SAFFRON AND ITS IMPORTANCE IN SPAIN.

The cultivation of saffron (*Crocus sativus*) is extremely ancient in Spain, although only in the VIIIth century the Arabs improved and extended it to the areas where it is now found.

Spain and South America are the only countries where the Arabic *alzafrán* remains in the word *azafrán*, while in other parts of the world is found, more or less changed, the primitive Persian *safrán*. Saffron has lost its original importance as a colouring plant, the dyes that could be produced with it not being strong enough and having been advantageously substituted by mineral dye-stuffs. But its wide use in medicine, in the making of pastry and liquors, in the manufacture of soup paste (pasta italiana) and, above all, as seasoning, are quite sufficient to justify the importance of its cultivation and the value of its collection in Spain.

In the whole peninsula and, especially in such areas as La Mancha, Levante and Andalusia, no food is cooked without being seasoned with saffron. The long Spanish domination in Central and South America has left in those countries the same taste that is, moreover, peculiar to Mediterranean nations. The area of land under saffron cultivation in Spain is now about 12 406 hectares, distributed as follows:

Provinces	Hectares
Albacete	4 350
Teruel	3 750
Cuenca	1 920
Toledo	1 160
Zaragoza	590
Valencia	400
Murcia	124
Ciudad-Real	98
Soria	14
	12 406

As the average saffron production is about 12 kg. of stigmas per ha., there is an annual average production of 148 872 kg. that, at the average price of 224.86 *pesetas* per kg. (data, 1919-23), gives the total yield a value of 33 475 357·92 *pesetas*.

In addition, after the fourth year saffron must be uprooted, when there is a yield of tubers (commonly termed onions) of about 12 500 kg. per ha. (Plate I, figs. 1, 2, 3). This allows about 387 687.50 kg. for new plantations and for feeding livestock and, at the average price of 10 *pesetas* per 100 kg., has a value of 3 876 875 *pesetas*. The saffron leaves, termed *Espartillo*, when dried, are stored for use as a winter feed for dairy cattle. The average production being about 800 kg. per ha. there is an annual crop of 9 924 800 kg. which, at a price of 4 *pesetas* per 100 kg. reaches a total of 396 992 *pesetas*.

The value of the annual output of saffron in Spain is as follows:

Stigmas	33 475 357	pes.
Tubers.	3 876 875	»
Leaves.	396 992	»
Total	37 649 224	pes.

From the above, the importance can be seen of saffron in national economy. The plant occupies $^1/_{60}$ of the total area occupied by industrial plants, and as regards the value of the crop, takes the fourth place being surpassed only by sugarbeet, red pepper and sugarcane.

From the following tables (I. and II.) may be seen the great importance of the saffron trade in Spain, owing to its always having been celebrated for its strong colour and penetrating aroma.

The amount exported is about half the total production, hence, the consumption per head in Spain is about 4 gm. per annum.

The chief markets are in: La Mancha, Albacete; in Aragón, Calamocha and Montalbán, and the chief export towns, Barcellona and Valencia.

Saffron is graded by the length of the stigmas, the aroma, the colour and the degree of purity, into the following four classes: *Selected*, *superior*, *superior ordinary* and *ordinary*.

The former are sent to Marseilles, Pitiviers, London, Liverpool,

TABLE I — *Kg of saffron exported from* 1919 *to* 1923.

Countries	1919	1920	1921	1922	1923
Algeria	1 715	21	840	(1)	
Argentina	17 600	11 751	15 523		
Cuba	10 535	22 514	13 135		
United States	2 071	3 036	1 014		
France	46 792	29 274	26 823		
England	7 258	3 097	2 416		
Other countries	42 749	18 077	8 320	45 989	50 922
Total	128 727	88 470	68 075	45 989	50 922

(1) From this year all data are combined

TABLE II — *Value of exported saffron*

Years	Kg exported	Price per Kg	Total value	
1919	128 72	132 53 pts	1 034 443	pts
1920	88 470	170 27	15 063 786	»
1921	68 075	200 —	13 615 000	»
1922	45 989	271 73 »	12 496 590	»
1923	50 922	350 86 »	17 822 700	
Average	76 436	224 86 pts	15 206 504	pts

Amsterdam, Hamburg and Trieste The latter to Cuba, South America, North Africa and India, where Spanish saffron is highly valued and is used for religious ceremonies

SPECIAL CONDITIONS OF SAFFRON CULTIVATION.

Saffron cultivation requires a great deal of hand labour, especially in gathering the flowers, which must be done on many successive occasions, and in the separation and drying of the stigmas. Therefore, the area of saffron cultivated by each labourer is not large, and is what he can take care of with his family, and varies from 5 to 50 ares

The land under saffron is always to be found near well populated centres in order to takes advantage of the labour and to save time. This proximity is also essential, excrement being the only manure used

The persons who cultivate saffron are not generally farmers but working men of all kinds (masons, blacksmiths, tanners) who, on Sundays and feast days, and before and after their daily work, alone or with their wife and children, take care of the saffron crops. Under such conditions the saffron production is for them an extra source of income ; being easily preserved and fetching high prices it is very valuable during times of shortage. It may therefore be said that saffron provides comforts for the working class and lessens the effects of labour crises.

The cultivators of saffron are not generally the owners of the soil, but hire the land for four years. The owner usually grants a lease to a farmer who, in his turn, divides the soil into plots of 5 to 20 ares being guarantee for the rent of those to whom he has sublet the land. In the province of Albacete this rent varies from 120 to 300 pesetas per ha., but reaches 450 pesetas near Valencia, a much higher price than is paid for unirrigated land. The leases are usually terminated on St. Andrew's Day, 30th of November.

The area cultivated by each worker not being large, causes changes in the total cultivated area and in the whole production to be very small, hence, both area and yield may be considered as constant quantities.

In Spain, saffron is usually grown on the same soil for four years before uprooting, as, after that, the tubers multiply, almost reach the surface, hinder cultivation, cause the growth of weeds and so lessen the output. In France, saffron is uprooted after the third year, because owing to a richer manure the tubers multiply in less time. To obtain a second satisfactory crop of saffron, 20 vears must be allowed to elapse on unirrigated and 10 on irrigated soils.

AGRICULTURAL CONDITIONS.

The climate of the areas in which saffron is cultivated in Spain may be called temperate and peculiar to upland. Although the crop is found in Valencia and Murcia, it is only on the limits of Requena and Jumilla that, being near Albacete, have the same climate instead of the warmer one found in the central parts of those provinces. In Table III is shown the average yearly temperatures and the amount and frequency of rainfall in those provinces (sea page 14).

The average temperature for the whole saffron area is from 10°-15°C., with a minimum of 12°C. and a maximum of 38°-40°C.

TABLE III. — *Temperature and rainfall data.*

Provinces	Average annual temperature	Rainfall in mm.	Number of rainy days
Albacete	13.6° C	381	61
Ciudad-Real	15.0° »	456	97
Cuenca	11.6° »	438	98
Soria	10.2° »	567	96
Teruel	11.8° »	387	65
Toledo	14.0° »	387	64
Zaragoza	14 7° »	295	66

As saffron remains inactive and deeply buried in the soil during the summer it cannot be injured by excessive heat, and during the winter the labourer protects it with a covering of well softened and fine earth so that the plant is not affected by the great differences of temperature. If the autumn is warm the flowers are early, but during this period frosts are very dangerous.

The saffron area may be termed dry, as in few places the annual rainfall exceeds 400 mm. To obtain a good yield two heavy rainfalls are sufficient, one in spring for producing the new tubers required to form the crop during the following autumn and another at the end of summer or beginning of autumn to help the blossoms and flowers.

In such conditions of temperature and rainfall is obtained the celebrated *azafrán manchego y aragonés* so appreciated in foreign countries for its bright colour and penetrating aroma and that can be compared only to that grown in France in the Gatinais.

Saffron grown on irrigated land gives a more regular and abundant crop, but has not such a good colour and aroma and is therefore sold at a lower price.

Saffron does not require a rich soil, but it must be light so that the tubers can develop. A good quantity of lime is also beneficial; the best saffron is grown in the Albacete province where the soil contains more than 40 % of lime. Cold and damp clay soil is not suitable for saffron. The manure almost exclusively used is excrement. After a short decomposition it is applied in amounts of 10 to 15 000 kg. per ha., before the last cultivation in the preparation of the plantation, and nothing more is added.

If the manure is not very abundant, it is put in the furrow when planting out. In Requena (Valencia) the excrement is mixed

with. $^1/_5$ of its volume of ashes. House sweepings and residues are also used after having been dried and mixed with earth.

The Estación de Agricultura General de Albacete has carried out manurial experiments and the best result has been given by the following application per ha.

Rotted manure	20 000 kg.
Superphosphate $^{16}/_{18}$	200 »
Potassium chloride (50 %)	150 »

During the following years 50 kg. of ammonium sulphate is spread in the furrows.

The yield of saffron is greater in France owing to the heavier rainfall and the more abundant manure, which causes more vigorous germination and consequently a greater quantity of flowers.

METHOD OF CULTIVATION.

Plantations being small all labour is done by hand, using as implements the spade for deep work and the hoe for breaking up the surface. For preparing the soil it is necessary to dig over the land twice ; once in March to a depth of 25 to 35 cm., all stones, roots and rubbish being removed. The second takes place at the end of April or beginning of May, has a depth of 10 to 15 cm. and prepares the soil for the planting out. Manuring is carried out at the same time.

Planting out is done from the middle of May to the beginning of June. Middle sized tubers, sound and without the external covering, are put in double rows at a distance of 6 cm. and then again in another row at a distance of 3 cm.

These rows are placed at the bottom of small trenches, having a depth of 10 to 12 cm. and a breadth of 45 cm. The soil taken from one trench is used to cover the tubers of the preceding trench. If not given previously, manure can be applied during this operation.

No other cultivation is done in the first year until September, when the soil between the rows is lightly turned over with the spade to a depth of 6 or 7 cm.

In October, before the blossoming of the flowers, the surface of the soil is broken with the hoe and the operation is repeated

until the ground is well softened and does not hinder the growth of the plants.

After the harvest, at the middle or the end of November, the soil among the rows is once more dug to a depth of 12 to 15 cm. and, if not previously given, manure can then be mixed with the soil. At the end of April or beginning of May the saffron leaves are cut with a sickle and dried in the sun as winter food for livestock. After this the soil among the rows has to be once more dug to the usual depth.

On the 24th of June the ground is dug perpendicularly to the rows, thus turning in the residues left when cutting the leaves. This is considered a very important operation and its utility is celebrated by popular sayings From this time on, until the ground is prepared for the gathering, the spade is used each month.

During the third and fourth year the same cultivations are repeated After getting the fourth crop of saffron, in the month of May when the new tubers are already formed, the plant is dug up

The external covering is taken from the tubers, the old and diseased tubers are thrown away and what is left is used for new plantations or food for livestock

Gathering and preparation of saffron

The gathering of the saffron flowers, known as " Cojida de la Rosa ", takes place from the end of October to the middle of November, according to place and state of cultivation, but generally reaches its maximum on All-Saints Day (the first of November).

The gathering (Plate II, fig 4) is done by women and children who go to the plantations before daylight, working from the first dawn untill about ten ; the work must be done quickly or the flowers would be withered, hence, a sufficient number of workers must be employed for this purpose. In cloudy weather the work may last longer ; after a white-frost time must be allowed for the flowers to dry before beginning.

The workwomen stand in a row on one side of the plot, near three rows, and walk in the direction of these rows, gathering the flowers of the central, right and left rows and putting them in a basket at their feet. They get thus to the other side of the plot where they walk in the opposite direction and so on. This must be repeated during 10 or 12 days, as long as the flowering lasts.

PLATE I

FIG. 1. — Saffron tubers with the sheath leaves that give them the appearance of a bulb

FIG. 2. — Tubers without their sheath leaves and showing the buds

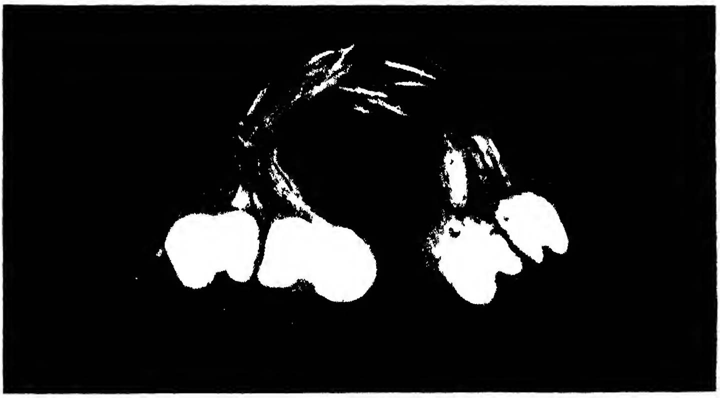

FIG. 3. — Section through a tuber

PLATE II

FIG. 4.—Gathering [illegible] flowers

FIG. 5 No. [illegible] Typical scenes during the treatment of the flowers

The gathering is paid as piece-work, the flowers being weighed, at the rate of 15-20 centimes per *libra* (460 gm.). The flowers collected daily must be cleaned, the stigmas being removed, as it is for these that saffron is cultivated, but this operation must not be delayed till next day, as it becomes much more difficult if the flowers are no longer fresh.

The flowers are then brought indoors and put on tables round which the working women sit, each of them with a small earthen pot in which are placed the stigmas. (Plate II, figs. 5 and. 6). The work proceeds in the following manner: with the left hand they take a flower, cutting with the thumb nail the pistil under the corolla and pulling off with the right hand the stigmas. This operation also is paid as piece-work, 20 centimes per *onza* (1 *onza* = 28.75 gm.) of cleaned saffron; 80 kg. of flowers are required to obtain 1 kg. of green, or fresh saffron.

Green saffron must be dried, after which it can be preserved, developing at the same time, the colour and aroma that are its chief qualities. The flowers are desiccated by placing on silk sieves on worm ashes or in small earthen ovens made for that purpose. When green saffron is put on a sieve in small bunches the dampness causes it to adhere to the silk, but when dried the saffron slips over the silk. Therefore, the operation of putting the sieve near the fire must be repeated until the saffron slides over the silk. From 5 kg. of green saffron 1 kg. of dried saffron is generally obtained. After drying, the saffron is allowed to cool in a dry place, and is then packed in woollen material.

For export the saffron is packed in boxes, barrels or sacks.

Causes of damage to saffron.

Mice are very dangerous to saffron plantations, as they cause great damage and so they are controlled by all possible means. Sulphur, tobacco and hot pepper are generally burnt in order to drive them away. The most injurions saffron disease is the "Podredumbre" or "Hongo del Azáfran" (*Rhizoctonia violacea* Tul.). When the disease is severe nothing can be done but to dig up the plants, no way being known by which it can be controlled.

At the "Estación de Agricultura General de Albacete" attempts are being made to obtain tubers by means of seeds and artificial

fertilization, from sound tubers collected on plantations attacked by the disease, whith the object of obtaining saffron immune to the disease.

RICARDO DE ESCAURIAZA,
Agricultural Expert
to the Estación de Agricultura General de Albacete.

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THE IMPORTANCE OF LARGE AND SMALL FARMS IN INTERNATIONAL COMMERCIAL RELATIONS. *

The question here dealt with is extremely difficult from a theoretical point of view and very delicate from a political and social standpoint, but the correct solution of the problem may contribute largely to the health of international economic life, which has not yet been able to regain the equilibrium lost in consequence of the world war and the cataclysms which resulted from it.

As a consequence of the movement towards the towns and the increase of industrialism in most of the countries of Western Europe, they were obliged, even before the war, to import raw material and agricultural produce to support their population on the one hand, and on the other, to export their industrial products to provide work and in this way to balance their transactions.

This mutual exchange between agricultural and industrial countries, supplemented by the movement of capital and by emigration, has contributed largely to the remarkable economic development of the New and Old Worlds. As a consequence, the question as to what was the reason of the intensity of this exchange is suggested. It may be stated that, together with the commercial expansion of industrial countries, the intensity of international relations depends on the facilities for exportation of agricultural countries, which results from their rural production and internal consumption, as well as from their purchasing power of products of foreign origin.

But these factors depend also in their turn on the agricultural constitution of the country and on the level of general education and especially on agriculture.

If a study be made of the situation of world economy previous to the war, from the point of view of international relations, it is

* Report presented to the Section of Rural Economy of the Twelfth International Agricultural Congress, Warsaw, June 1925. (Full Text).

seen that in the countries concerned there are four chief types of economic-rural organization.

I. The Agricultural Organization of Western Europe. — The characteristic feature of this is the greal quantitative preponderance (both in number and area) of the smalt and medium size country estates and the high development of the pecuniary factors in the small farms.

Even the small rural properties, as has been shown by the interesting work carried out for a number of years by the Swiss Secretariat of peasants, under the direction of Prof. LAUR, are primarily business enterprises having for object the making of a profit on the sale of agricultural products.

The area of the farms has no influence on their character of enterprise ; it depends rather on the nature of the produce ; large estates are occupied with the production of wheat, while small properties deal with animal produce and horticulture. We have therefore to deal with a certain specialization of small and large rural properties, which is necessary in case of economic isolation of a given country, in order to provide for its internal requirements. The careful investigations of Prof. BRDLIK have proved that this specialization has, in addition, a deeper economic significance.

However, all these types of property produce for a market where they mutually supply each other with various requirements, in consequence of which the market becomes very absorbent and assists the development of industry. This specialization also favours, in normal times, the development of international commercial relations, (examples :— the products of stockbreeding in Denmark and Switzerland, sugar in Germany, Poland and Czecho-Slovakia, fruit and wines in France and Italy). The large and small rural properties share equally in this exportation ; the latter have therefore also their part in international exchange. The stimulus encouraging production lies primarily in the desire for profit from rural economy, treated as an enterprise.

II. The Agricultural System of Eastern Europe. — Before the war, up to a certain point it was a survival of the feudal times, when only the large rural estate entered into the business of production, a type of partial capitalist enterprise ; the peasant farms have on the contrary a signification of consumer and supplier of manual labour and teams required by the large estates. In places where the production of the farms was

not developed, and where the peasants paid rent, their property had the character of natural rural economy, producing not for sale but to satisfy their own requirements and to enable them to pay the rent which was frequently levied on produce.

The freeing of the peasants, which has radically changed their relations from a social and legal point of view, has not caused essential changes in economic relations, although it contained the possibility of equally radical changes.

The large farm remained for a long time the only business producer with the character of a capitalist farm, while the small peasant estate, newly formed, followed a natural development and produced only in order to satisfy the immediate requirements and to pay the high taxes and the purchase money of the land obtained. This latter, moreover, has been obtained by the freed peasants in the Russian districts in too small an amount, especially in view of the very low level of agriculture and the rapid increase of the population, the surplus of which has not been able to find employment in towns in consequence of the very slight development of industry. They were therefore forced to supplement, by renting, land of the large estates, and in this way were able to get from it a high revenue which it was increasingly difficult to obtain by means of their own administration, owing to the economic policy of the Russian Government, by which the development of agriculture was neglected.

The Russian peasants were forced to limit their consumption to a minimum in order to satisfy charges arising from too high a purchase price, heavy taxes and the large amounts paid for the rented land. It is for this reason that we have such facts as the exportation of wheat from Russia in years of famine, or the continual sale of wheat by the peasants in autumn at cost price in order to pay their rents and taxes, only to buy it back more dearly in spring by means of some chance profits.

Here therefore, even the small farms equally with the large, share in exportation ; the participation of the former was, however, to a certain extent qualified by fiscal and economic constraint on the part of the State and of the large estates.. The stimulus to production has not been therefore, as in the West, the desire for profit from the rural estate, treated as an enterprise, but the necessity of satisfying the most elementary needs and of making provision for burdens imposed by the social and political system. It

should however be mentioned that the agricultural reform undertaken by the Russian Government after the first revolution, and, as a consequence, the greater care taken of the same property, have produced rapid results in raising the well-being of the country. This leads us to think that, in this part of Europe, the small estate could develop in the same direction as that followed in the West.

III. The Agricultural System of the New World (United States, Canada, Argentina). — This farming system, was already before the war based on the principles of capitalist production ; it was therefore very closely connected with the international markets and it was to the requirements of these markets that production was almost entirely adapted.

IV. The various Colonial Systems. — These systems are based on the production of plantations worked by capitalist planters, natives or farmers, with the object of providing the market with certain products, so that they take an active part in international commercial relations.

It is evident that this classification under four types is quite artificial. In reality it is much more complex.

***

It follows from what has been stated above that the small and large farms of the West of Europe, the farms of America, the various types of farms in colonial countries, and lastly the great estates of the East of Europe, before the war, took an active part in international trade, as agricultural enterprises exporting for profit. On the other hand, the small estates in the East of Europe did not, properly speaking, produce for sale ; if they sometimes supplied agricultural produce, it was almost exclusively under the fiscal pressure of the State, or when they were forced to do so by local conditions of possession, in cases where the owners found themselves obliged to pay large amounts for rent.

Some of the colonial farms were in touch with the markets simply from force of circumstances. Also the 2nd category of farms could not be considered as agricultural enterprises, as their object was not to produce with a view to profit, but simply to supply their own immediate needs. Contrary to the first category which has been referred to, which had developed in a considerable measure

the pecuniary factors in these farms, the second category has only attached slight importance to such factors.

Both the first and second of these categories evidently form an essential part of the particular systems of the farms of the States or of national agricultural economics. The latter were connected with each other owing to the complicated relations of commerce, finance and politics and formed a certain co-ordinated unit which was the system of world economy, before the war, in approximately a state of equilibrium, although even at that time certain symptoms that this equilibrium was not stable but could be upset, were evident. And, as a matter of fact, that equilibrium was lost by the war; its disturbance has brought about an economic crisis, perhaps in different degrees, but at any rate felt generally in both hemispheres for a series of years. Moreover, the regaining of this equilibrium is now the object of efforts undertaken by the most eminent statesmen, politicians and economists.

The economic consequences of the world war might been reduced, within the limits of the problem with which we are dealing, to three principal heads:—

(1) The almost total elimination of Russia from international commercial relations, both as an exporting country for agricultural produce and raw material and as an importing country for manufactured goods.

(2) The modifications in the international financial relations, in consequence of which America has become the creditor of Europe, after having formerly been its debtor, while at the same time she has acquired the necessary capital for the development of her industrial development.

(3) The development of measures having as their object emancipation, in colonial countries aiming at both political and economic independence.

What connection is there between the above and the problem with which we are dealing?

The connection can be shown by a general analysis. Let us first of all consider the relations in Russia.

Before the war Russia was the most important exporter of the five principal kinds of wheat on the world market. Of the total quantity of wheat supplied to this market, Russia's share, amounting to 600 million quintals, representing 35.10 %, while

the shares of other countries scarcely reached the following figures :—

Argentina	16.7 %
Rumania and Bulgaria	3.7 %
Canada	3.2 %
Australia	2.7 %

It is evident that the disappearance of such an exporter as Russia must upset the equilibrium of this market. Here the question arises as to what has caused such a sudden restriction of Russian exports. Evidently it has resulted from decrease of production caused by the world war, the downfall and its consequences, the almost total liquidation of the large estates, which before the war sent their produce to the markets, and the disappearance of large scale agricultural production.

However, according to the estimates of Messrs. ORGANOWSKI and GRONAN, Russian economists, the large estates supplied the markets with barely 25-32 % of the total agricultural produce sent there by Russian agriculture.

The ruin of Russian exportation cannot therefore be explained solely by the liquidation of the large estates, although that liquidation must have had a strong influence. The problem is much more complicated. It would seem that the key to this riddle and the explanation are to be found elsewhere. The production for sale of small estates had as its real motive a pressure exerted in some way, as has already been shown. When that pressure ceased to be felt, there was no longer any other factor capable of forcing the Russian peasant to produce for sale ; his mentality contained too little initiative for enterprises and consequently too little desire for gain, the principal motive of production to the farmer of Western Europe.

Moreover the objective economic conditions were not favourable to production for sale. Ruined industry, depreciated currency, could not offer any concrete value to the farmer in exchange for produce. As for what he most desired, land, it was given to him gratuitously.

Consequently, the farmer consumed more ; he adapted production solely to the needs of that consumption, sending to market only such produce as had been taken from him by force or such as

could assure him the possibility of providing for the few requirements which he was not in a position to satisfy on his own farm. The weak relations existing between the small agricultural units and the markets, and consequently their negative value in international commercial relations, which have already been mentioned, are here fully shown.

To the attempts made by the Soviet authorities, to force the small farmer to give up his produce to the towns, the latter replied by reducing production to a minimum, which ended in famine in Russia and forced the authorities to capitulate and to attempt a new political economy, allowing the free use of agricultural produce and contenting themselves with the collection of taxes in produce indispensable for the maintenance of the army, the administration and in part for the requirements of the towns.

The inability of the small Russian farmer to adapt himself to the exigencies of free production for sale, based on motives of a commercial nature, was further aggravated by the defective political economy of the Soviets, who arranged a great disproportion in price between manufactured goods and agricultural produce, to the detriment of the latter. This policy arrested the development of small farms, tending to develop in them a preponderance of the pecuniary element and to prevent them in this way from participating in an active manner in international exchange. What has been said of Russia is also true to a considerable degree of the other countries of Eastern Europe, where large estates were broken up and where small estates had not yet been reorganised for direct production for sale (example :— Roumania).

On the other hand, in countries where the small farms had been in closer contact with the markets before the reform, agricultural reconstruction has not caused such injurious consequences (Baltic States).

The sources of raw materials and agricultural produce, as well as the selling markets of manufactured goods, being in this way lost to international economic life, it became indispensable to replace them in some way. The United States lent assistance as regards the first point. They reduced their own consumption and enormously increased agricultural production, and succeeded in filling the gap left by Russia. Thanks to American agriculture, Europe has not succumbed to famine.

However, the war fundamentally modified the financial basis

on which, before the war, Europe had been the creditor of the United States.

The latter provided for the engagements arising from their debts by means of supplies of raw materials and agricultural produce. In this way, equilibrium of the balance has been established. The world war transformed the debtor into creditor. Europe could not now import agricultural produce from the United States by reason of the income from securities possessed or of the interest on credits which had been granted. Europe is now the debtor of the United States, and is forced to buy their produce and raw materials for cash or on credit, as she is not in a position to counterbalance their value by the export of manufactured articles. American industry is secured by customs duties against European competition. The balance of payment is consequently always to the detriment of Europe.

On the other hand, agricultural produce and raw materials from the United States are now too costly for impoverished Europe. Consequently the eminent American economist TAYLOR, estimates this question at its true value in affirming that in future the problem will not consist in the quantity of food stuffs which the United States can supply to Europe, but in the economic possibility of delivering these products to her. The provisioning of Europe by the United States is not a privilege for Europe, but a business for the United States. It is not only a philanthropic work of assistance, but primarily trading based on sound principles TAYLOR, however, regards with pessimism the out-look of this trade in the future, affirming that Europe can eat more than she is in a condition to pay for and that nobody grants long term consumption credits. Moreover, there is room for a little scepticism, for other reasons, respecting the future of European-American trade in agricultural produce. The rapid development of the United States, the growth of their cities and the increase of industrialism, will probably, in a short time, cause the United States to be transformed from an exporting country into an importing country. In that case Canada and the Argentine Republic will export to the States their products in the first place, at the same time serving as their sale market. For the present, however, Europe suffers most from the elimination of Russia from the market and from the loss of its exports. This problem forms a capital question of to-day.

It follows from the above, and from the attempts at emanci-

pation by colonial countries or by those which, being independent, are in a preponderant sphere of economic influence of the States of Europe, that world economy, so far as it will reestablish the equilibrium upset by the war, will be based on principles other than those of the pre-war period.

It seems as though the period of economic imperialism is fading away. The future belongs rather to certain self-sufficient economic organisations, possibly to international or regional organisations. International commerce, however, will not, disappear. It will only be limited to industrial or commercial articles for production of which special economic organisations would be most suitable, either for climatic reasons, or for intellectual or demographical reasons.

What then is the importance which more or less extensive farms may have in this new system of world economy ? The much discussed question of the importance of the small and large estate is not considered here, mainly because this problem, owing to extremely accurate investigations, because based on the inductive method of Professors BRDLIK and LAUR, has assumed an objective character, up to a certain point, and enables an opinion to be formed independently of social or political views. In relation to the present problem, it is sufficient to draw attention to the fact that, being self-sufficient from an economic point of view, mentioned above, will compel the various countries to constitute their agricultural systems in such a manner that all types of their farms are maintained in the quantity required for attaining optimum production according to the specialization of farms of different types, either of crop or stock production.

On the other hand, it may be pointed out that, in view of the agricultural revolution which is seen to-day, the small peasant farm has acquired a greater international importance in comparison with that of pre-war times.

The changed nature of that farm in the more backward countries, from an economic point of view, by means of the development of pecuniary elements, the raising of the standard of life and, in that way also, the connection of the farm by voluntary ties to the market, should be the principal care of the political economist, and it will be necessary to give to this subject not less attention than is given to the development of agricultural production itself, but this cannot be attained until after the solution of the first problem.

The production of small farmers, which up to the present has, in the West, kept to the type of production based on constraint, or having a patriarchal character (according to the distribution of production by types, introduced by a Polish economist M. ZAWADZKI) should be raised to a higher grade and transformed into a commercial production type — individualistic, characteristic of present economic life in West Europe, while retaining certain specific features resulting from its agricultural character. This end may be reached even by the development of the natural peasant farm into a pecuniary business, as the Russian economists PROKOPOWIEZ, BRUCKUS and others rightly state, contrary to those who support the theory of the artizan-peasant family, professed by CZAJANOW, CZELIKEEV, and others.

In order that the development referred to may be brought about M. ZAWORLI's theory of production requires the existence of the following conditions: —

(1) The individualist form of productive force in agriculture, that is to say the freeing of the small peasant farms from the bonds of common possession or agricultural constraint

(2) The relation between production and economic activity, the perception of which cannot be awakened in the psychology of the small farmers except by means of a political economy which establishes, in an equitable manner, the relative prices of manufactured goods and agricultural produce, and which would assure the yield of these two branches of economic life.

(3) The awakening of the desire to work. This desire is however, always shown among farmers when the first two conditions are realized and when the family sense, as well as the sense of economy, strongly developed in country-life, based on the unshaken right of property, respected by the State, enables the fruits of work for the public welfare and future generations and consequently for the welfare of the whole of humanity, to be reaped.

WITOLD STANIEWICZ,
Professor of Rural Economy and Agrarian Policy, in the Faculty of Agriculture, University of Vilno (Poland).

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Papers

THE INFLUENCE OF ELECTROLYTES ON THE ABSORPTION OF HYDROGEN IONS.

In a former article (1) a description is given of some experiments made to ascertain how electrolytes affected the absorption of ions of ammonium (*antagonistic* action of ions). These experiments showed that electrolytes very considerably reduce the absorption of ammonium ions, the strong acids the most (50-60 %), the neutral and acid reacting salts less, and least of all the alkali reacting salts, which in some cases increase the absorption (Table 1). The latter probably depends on the fact that the alkali reacting electrolytic solutions increase the dispersion of the basic particles.

The H ions have therefore very great supplanting properties, which correspond to the extremely weak hydration of H ions. As it was expected that the electrolytes would only have a feeble influence on the absorption of H ions, the following experiments were made :—

(1) B AARNIO Die Adsorption des Ammonium-ions aus Losungen verschiedener Ammoniumsalze und die Einwirkung von Elektrolyten auf dieselbe *Zeitschrift fur Pflanzenernährung und Dungung*, Part A, Year 1, No 5, 1922.

TABLE I. — *Absorption of NH_4 ions from a* 0.1 *N. solution, by clay soil.*

100 gm. soil absorb:					
from 0.1 N. $(NH_4)_2SO_4$ – solution			from 0.1 N. $(NH_4)_2HPO_4$ – solution		
without addition	absorbs 0.4154gm.NH_4	without addition	without addition	absorbs 0.6465gm.NH.	without addition
+ HCl 0.1 N.	0.1824 »	— 56.09 %	+ HCl 0.1 N	0.2546 »	— 60.62 %
+ HNO_3 »	0.1896 »	— 54.36 »	+ HNO_3 »	0.2546 »	— 60.62 »
+ H_2SO_4 »	0.2258 »	— 45.64 »	+ H_2SO_4 »	0.2799 »	— 56.71 »
+ $Al_2(SO_4)_3$ »	0.2456 »	— 40.87 »	+ $Al_2(SO_4)_3$ »	0.3856 »	— 40.39 »
+ Mg SO_4 »	0.3449 »	— 16.97 »	+ $CaCl_2$ »	0.4623 »	— 28.49 »
+ $CaCl_2$ »	0.3598 »	— 13.57 »	+ $NaNo_3$ »	0.5129 »	— 20.66 »
+ $NaNo_3$ »	0.4038 »	— 12.57 »	—	—	—
+ Na_2CO_3 »	0.4812 »	— 15.84 »	+ Na_2CO_3 »	0.6014 »	— 6.98 »

Experiment I. — 10 gm. of heavy, neutral, glacial clay were treated with 100 gm. 0.01 N. HCl or H_2SO_4 respectively, and the concentration of hydrogen was determined electrometrically (according to L. MICHAELIS). In solutions of 0.01 N. HCl — and H_2SO_4 — employed, the P_H was 2.12 or 2.16. Then so many electrolytes were added (NaCl, K_2SO_4, $CaCl_2$) that the solution with respect to electrolytes was also 0.01 N.; 10 gm. of clay were treated with this solution, and the P_H determined.

TABLE II. — *Absorption of H ions from* 0.01 *N. HCl and from H_2SO_4 solution, by glacial clay from S. W. Finland.*

	P_H		P_H
0.01 N. HCl (without addition)	4.04	0.01 N. H_2SO_4 (without addition)	4.00
» » + 0.01 n NaCl	4.04	» » + 0.01 n NaCl	3.96
» » + » » K_2SO_4	4.09	» » + » » K_2SO_4	4.05
» » + » » $CaCl_2$	3.89	» » + » » $CaCl_2$	3.85
» » + » » $MgCl_2$	3.81	» » + » » $MgCl_2$	4.00
Originally 0.01 N. HCl	2.12	Originally 0.01 N. H_2SO_4	2.16

Absorption of OH ions from 0.01 *$Ca(OH)_2$ solution, by neutral glacial clay from S. W. Finland.*

			P_H
0.01 N $Ca(CH)_2$ (without addition)			9.03
»	»	+ 0,01 n KCl	9.03
»	»	+ » K_2SO_4	9.35
»	»	+ » $CaCl_2$	8.84
Originally 0.01 N Ca $(OH)_2$			11.34

Table 2 shows that the clay absorbs H ions very freely from solution 0.01 N., so that the concentration of the solution falls to about 0.0001 N. The elctrolytes used have hardly any antagonistic influence on the absorption of H ions. The H ions behave, therefore, very differently from the NH_4 ions with regard to absorption ; this might have been foreseen in the experiments with NH_4 ion absorption (Table I). From these experiments it appears that H ions are absoibed the most, and therefore supplant the other absorbed ions.

Experiment II — 5 gm. of soil (neutral clay, sphagnum peat and acid clay) were treated with 50 cc. or 0.1, 0.001, 0.001, 0.0001, and 0.00001 normal HCl and NaOH, and the concentration of H ions determined.

TABLE III. — *Neutral clay from S. W. Finland (5 gm. soil + 50 cm. solution)*

		P_H			P_H
	H_2O	7.19		H_2O	7.19
0.00001 N	HCl	7.15	0 00001 N	NaOH	7.19
0,0001 N	»	7.03	0,0001 N	»	7.15
0,001 N	»	6.64	0.001 N	»	7.34
0,01 N	»	4.48	0,01 N	»	10.04
0,1 N	»	1.59	0,1 N.	»	12.18

TABLE IV. — *Sphagnum peat from S. W. Finland (5 gm. soil + 50 cc. soltion).*

		P_H			P_H
	H_2O	4.73		H_2O	4.73
0.00001 N	HCl	4.62	0.00001 N.	NaOH	4.73
0.0001 N.	»	4.69	0.0001 N.	»	4.78
0.001 N.	»	4.58	0.001 N'	»	4.97
0.01 N.	»	3.60	0.01 N.	»	5 36
0.1 N.	»	1.69	0.1 N.	»	7.59

TABLE V. — *Acid clay from S. W. Finland*
(5 gm. soil + 50 cc. solution).

	P_H		P_H
H_2O	3.79	H_2O	3.79
0.00001 N. HCl	3.87	0.00001 N. NaOH	3.91
0.0001 N. »	3.75	0.0001 N. »	3.84
0.001 N. »	3.66	0.001 N. »	3.84
0.01 N. »	3 04	0.01 N. »	5.20
0.1 N. »	1.63	0.1 N. »	12.09

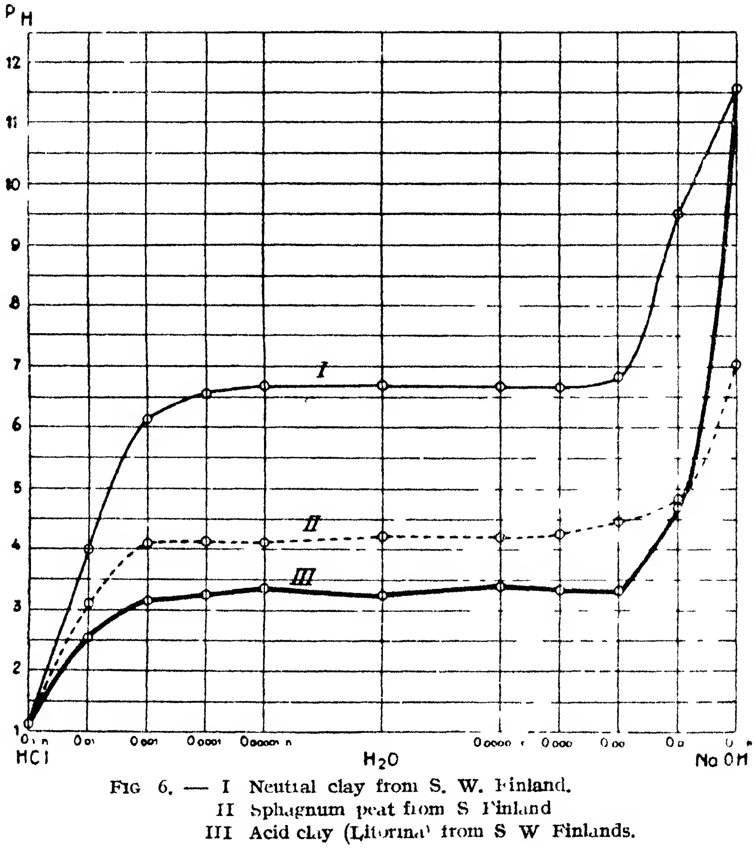

FIG. 6. — I Neutral clay from S. W. Finland.
II Sphagnum peat from S Finland
III Acid clay (Litorina) from S W Finlands.

As appears from tables 3-5 and figure 6, the P_H remains almost constant on both sides of the water solution, independently of whether the clay is acid or neutral, until the concentration of the added acids or alkalis becomes 0.001 N. A 0.01 N. acid or alkaline has a strong effect on the clay ; on the sphagnum peat the acid has a

considerable effect, but the alkali very little. A 0.1 N. acid solution reduced the P_H in all soils alike (P_H about 1.6). 0.1 N. alkaline also has an equally strong effect on the clay, so that the P_H becomes about 12. Sphagnum peat behaves quite otherwise, for with 0.1 N. alkali, the P_H only rises to 7.59. It may be assumed that the relatively strong alkali disintegrates the organic matter.

Experiment III. — The sphagnum peat was treated respectively with 0.1, 0.01, 0.001 and 0.0001 N. HCl and NaOH as before, with the addition of 0.01 N. KCl and $CaCl_2$ (the solution was therefore in relation to KCl and CaCl, 0.01 N.); the P_H was measured electrometrically. The results are shown in figure 7.

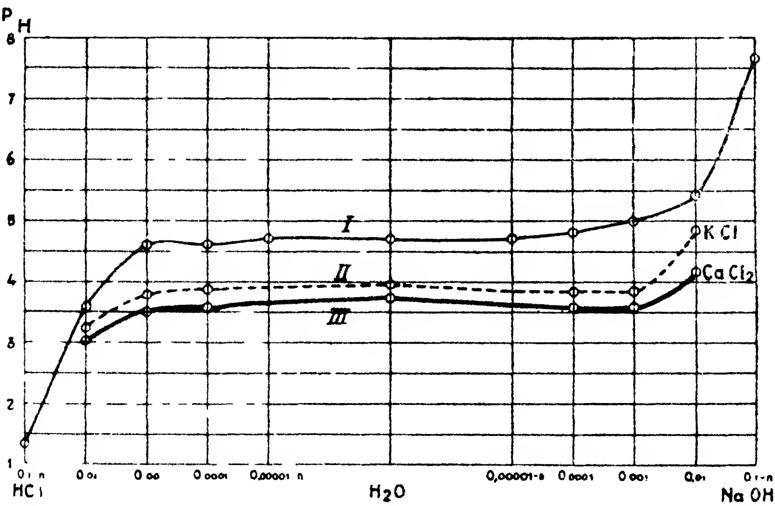

FIG. 7 — Sphagnum peat from S. Finland.

If curve I (without addition) be compared with curve II (HCl and NaOH + KCl) and curve III (HCl + $CaCl_2$ and NaOH + $CaCl_2$) it is seen that the electrolytes (0.01 N. KCl and $CaCl_2$) are almost entirely without influence on the H ions, because the pure KCl — and $CaCl_2$ — solutions exert an influence on the P_H equal to that of the 0.001, 0.001 N. HCl — and NaOH — solution, with 0.01 N. KCl or $CaCl_2$.

Experiment IV. — Acid Litorina clay, paimio and silkkila were treated as in experiment III. From the results it appears that the 0.01 N. KCl and $CaCl_2$ solution had no influence on the absorption of H ions.

Experiment V. — Neutral glacial clay and loam were treated as in experiments III and IV.

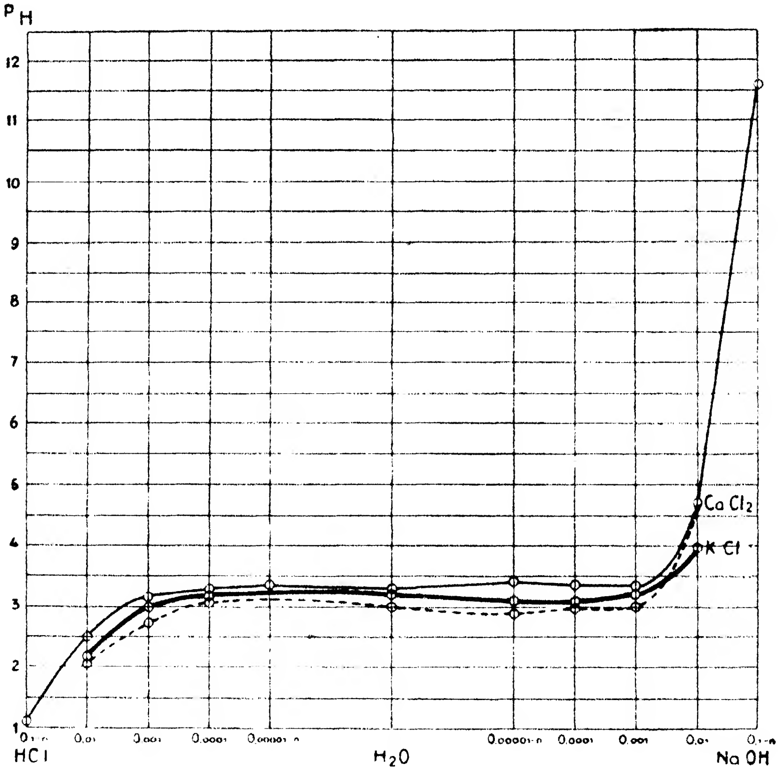

FIG. 8. — Acid clay (Litorina clay) from S. W. Finland.

With regard to these experiments, the conditions are the same as in experiments III and IV. The influence of pure 0.01 N. KCl and $CaCl_2$ solution on P_H is about the same; the rather weaker action of $CaCl_2$ solution is probably to be explained by the greater content of Ca ions of the neutral clays.

From the experiments it is shown that the electrolytes (0.01 N. KCl and $CaCl_2$) cannot expel the H ions from the clay. The phenomenon observed that the KCl solution gives rise to an increase of acidity in the soil solution (as compared with pure water solutions) cannot be caused by the K ions being interchanged with H ions, but that the K ions are interchanged with Al ions, and consequently the resulting aluminium compounds are hydrolysed.

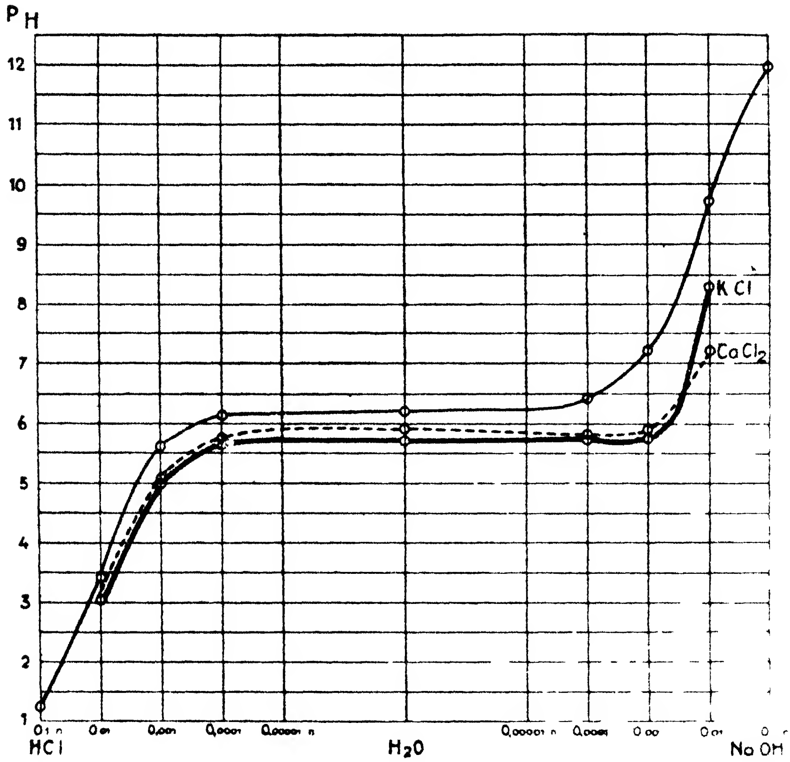

FIG. 9. — Neutral clay from S. W. Finland.

It is also clear that if the ions absorbed in a soil are to be determined, an acid must be used, because the H ions very strongly displace other ions (1)

B. AARNIO
Helsinski.

(1) Compare G. WIEGNER Dispersität und Basenaustausch *Zsigmonay Festschrift, Jubelband der Kolloid-Zeitschrift*, p 341, 1925

METHODS OF PRACTICAL APPLICATION OF RESEARCH ON SOIL PHYSICS (1)

Soil, in conjunction with climate, forms the basis of all agriculture. For example, the choice of plants to be cultivated, rotation of crops, preparation of the ground, etc. will vary according as there is a light sandy soil, or a heavy clay soil. Consequently the soil, in the end, becomes the deciding factor in farm management and in financial success.

According to the proportion of the mixture of stones, sand, silt and clay, soils change from light soils rich in sand to heavy and very heavy clay soils. Different methods of examination, as for example those of KOPECKY, and KRAUSS, also the simpler ones of KUEHN, etc., make it possible to determine numerically the constituent parts of a soil. But to appreciate the important bearing which the values obtained have with regard to the dimensions of the particles, demands great experience and special knowledge, such as cannot yet be expected everywhere from the practical farmer. It is therefore desirable to find suitable methods, which would enable the farmer not acquainted with soil science to understand the results of the physical examination of the soil, and draw from them the conclusions bearing on his husbandry.

The author believes now, with Th. L. HENKEL, to have found a method which, taking as a basis the OSANN triangle modified by KOEHNE, facilitates bringing the results of physical examinations of soil into close connection with agricultural practice.

In the angles of the triangle (Fig. 10) lie the three extreme types of soil. As the soils, as a result of their composition, approach more nearly to the middle of the triangle, denoted by the circle, they become more and more like each other, and form the group of medium soils included in the large square. But of course even the medium soils are not all of the same value, and hence the recognition of the differences is an absolute necessity in practice. Therefore the medium soils in the large square are divided by the vertical dividing line into two

(1) See *Landw Jahrbuch fur Bayern VII-VIII*, p 328, 1925

groups, of which the left contains the lighter, and the right the heavier types of soil. The inserted arrow line points out in what manner the transmission from the lighter to the heavier soils is gradually accomplished. The upper part represents the most similar soils, whilst both ends of the arrow line approach the extremes, of sand and clay.

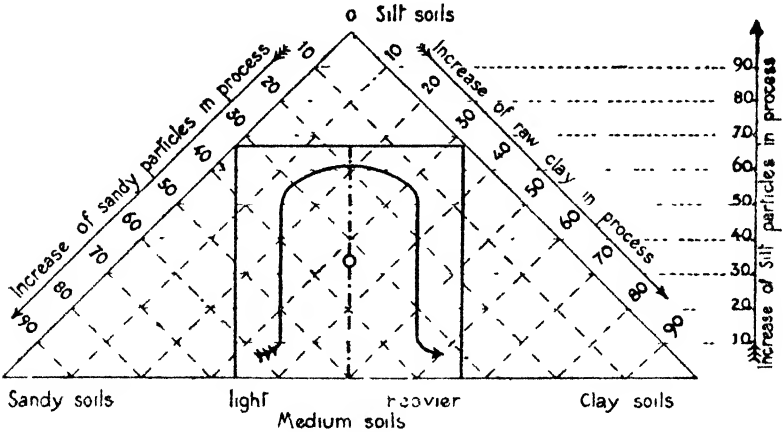

FIG. 10. — Diagram showing the results of the physical examination of a soil in practical agriculture.

This division of the soils into individual groups makes it possible to draw conclusions as to properties and applicability, if it is realised that specific properties are associated with sand, silt and raw clay. Figure 11. shows these, as also their effect on the transitional forms of the three types of soil.

Here again the best conditions lie on the centre line, which becomes the resultant of the play of forces of the different properties of soil.

Let it now be assumed that the soil consists of 60 % sand, 20 % silt, and 20 % clay. Figure 10. shows that this soil lies in the left lower point of the triangle, but still is no longer very far removed from the square of the medium soils. It still belongs, therefore, to the group of sandy soils, but comes very near to the medium soils. The extreme properties of the sand are still predominant, but are already modified. Its affinity to the sandy soils implies that it is fairly easy to till, that it will become warmed comparatively quickly in the spring, but as is shown by its nearness to the medium soils, it is perceptibly influenced by the action of the clay and silt. The

soil will therefore be able to exert some power of absorption on fertiliser salts, the permeability of water is no longer of such great account, etc. In the choice of crops to be cultivated it is still necessary to take into consideration those for light types of soil, but these will, with suitable cultivation, give good yields. It may already have been attempted, by careful preparation of the ground according to the conditions of the subsoil, to bring more important plants into cultivation, but with the heavy medium soils no very great success can be expected. This, after all, poor soil will not allow of expensive working equipment and intensive cultivation.

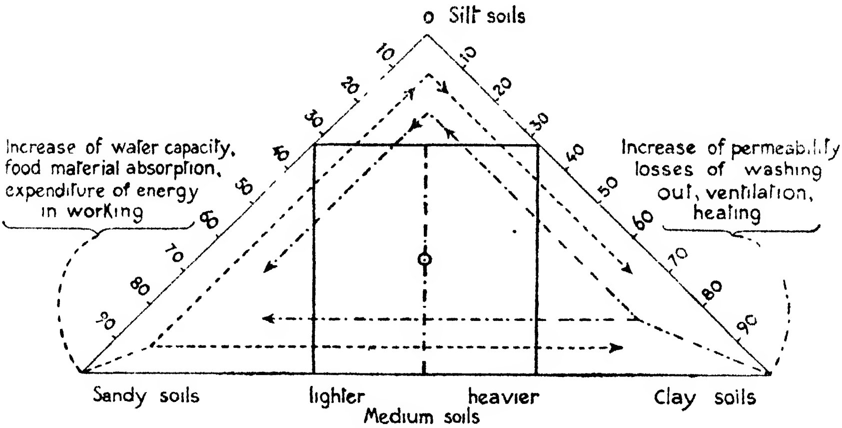

FIG. 11. — Diagram for ascertaining the properties and applicability of soils on the basis of a physical examination of the soil.

On the other hand, a soil which contains, for example, 30 % sand, 20 % silt and 50 % clay, lies in the lower part of the region of heavy medium soils. This soil, as the result of its proximity to clay, perhaps already possesses too much water-holding power, and in springtime will be rather later in getting warmed, on the other hand it has an exceptional capacity for absorption of plant food material, is considerably more easy to till than the true clay soils, etc. By proper cultivation it can also be made to give good crops, even with the more important plants. It can therefore be valued considerably higher than the soil of the first example.

A soil uniform in section has until now been taken as a basis. Many soils, however, show various layers to a depth of 1 m., par-

ticularly when they are considered for agricultural purposes. Thus a *sandy soil* may remain uniform to the depth mentioned, or may, below 50 cm., have a sub-layer of clay. In the first case the disadvantages, such as permeability, washing out of food material, etc., are more prominent than in the second. By *evenness* of the upper and lower soils, therefore, the extreme qualities are strengthened. In the second case, on the contrary, by the *opposite* conditions of the upper and lower soils, the extreme properties are mitigated. If a uniform *clay profile* continues unaltered, then the impermeability to water of the upper layer will also continue in the subsoil, whereas an under layer of sand carries off the deposit more easily. Here also, therefore, uniformity of profile strengthens the properties, whilst dissimilarity weakens them. *Silt soils* come between sand and clay, and therefore possess compensating physical and chemical properties ; consequently a uniform profile is *most valable* here, for it will be understood that a substratum of one of the two other kinds of soil affects the silt soil less favourably. The medium soils comprised in the square are expressed by dashes — likewise more or less even. The underlaying of a medium soil by another can therefore exert no important influence, at all events it is much less than in the case of the above examples with regard to sand and clay. If one of the lighter medium soils, on the contrary, has a substratum of one of the soils found to the left of the middle dashes, then it will be of less value, the further away the subsoil lies from the middle line towards the left angle. The same applies similarly for the right half of the square of medium soils.

In Fig. 12. it is sought to make clear the far-reaching (therefore area-dimensional) conditions described here.

If the upper and lower soils fall on the left, sandy, or the right, clayey angle, then the conditions are extreme ; if they lie together at the point or in the middle square, then they are more or less even. To the extent in which the upper or lower soils are removed from the centre line or the angles, the whole of the properties of the soils alter, now towards the bad, now towards the good side, as expressed by the arrows.

The examples given with reference to figure 10. can now be completed. If in the first example the soil lies in the sand angles, then the less favourable natural tendencies of the upper soil, inclining towards dryness, washing away of plant food material, etc., will be still further strengthened ; the soil will be reduced in value. If,

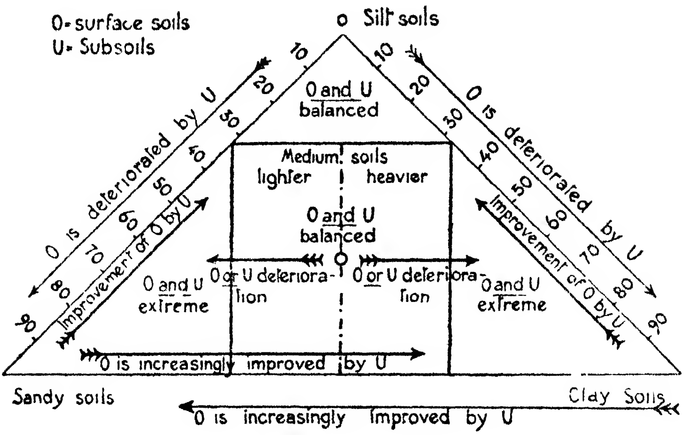

FIG. 12 — Diagram to explain the results of the physical examination of a soil for practical agriculture, in the case of soils with different layers.

however, the subsoil lies for example, in the right half of the square of medium soils, then it may be of considerably higher value.

Until now one constituent part of the soil has not been considered, namely, the stone content. In valuing this, the sizes of the stones must be taken into account. Thus, for example, the influence of a stone about the size of the fist cannot be compared with the same weight of stones of only the size of peas scattered through the soil. With a rising stone content, the soil, generally speaking, should be moved from the position in the triangle which its other physical analyses would give it, towards the left, lighter side.

Like all attempts to estimate the value of a soil according to a scheme, the foregoing has certain defects, still, the system here proposed may help even the practical farmer to inform himself quickly, on the basis of a simple examination, concerning any soil, and to recognise quickly its possibilities of usefulness.

A. NOSTITZ,
Technical High School, Munich.

THE INFLUENCE OF ELECTROLYTES ON DIFFERENT TYPES OF SUSPENSIONS OF CLAY.

The literature on the influence of electrolytes on suspensions of clay is relatively extensive. An exhaustive survey of the literature is given by Prof. K. GEDROIZ (1) in his treatise which appeared in 1915, in which the literature is divided into ancient and modern. In the first group GEDROIZ included the works which were published up to the year 1893, that is, those periods in which the colloidal substances of the soil were only slightly known. Here appear the works of Fr. SCHULZE (2), SCHEERER (3), Ch. SCHLOESING (4), A. MAYER (5), E HILGARD (6) and G. BODLAENDER (7). In these works important data were already collected, which gave a general idea of the influence of electrolytes on suspensions of clay, and also enabled certain of the suspensions to be more closely characterised.

Of the modern investigations GEDROIZ cited: the works of ROHLAND (8), MASCHHAUPT (9) and WIEGNER (10), ROHLAND considers the hydroxyl-ion as the most important factor in causing coagulation, which is contrary to the theory of FREUNDLICH (11), and which the last two named authors point out in their works. Prof. GEDROIZ is also of this same opinion, which is based on his numerous tests. As the above-mentioned work by GEDROIZ may be considered as a continuation and amplification of the earlier investigations, it will be more closely considered, and also the method of the work

I. IMPORTANT CONCLUSIONS DRAWN FROM THE INVESTIGATIONS OF GEDROIZ.

For the investigations, suspensions of red clay were used, which in the course of three days had not been deposited from water 7.5 cm. in depth. One litre of water contained 0.22 gm. of the clay particles. The tests were carried out in NESSLER's cylinders, and for these were used 50 cc. of the suspension, and 50 cc. of the corresponding electrolytic solution, of which the influence on the clay suspension was to be investigated. The duration of the test was 48 hours, but already after 24 hours important results were obtained. In the

tests the highest concentrations were observed which produced no coagulation — these are termed by GEDROIZ, rising values — and the lowest concentrations were noted at which complete coagulation took place, *i. e.*, the particles of clay had all coagulated and had been deposited.

The results obtained by GEDROIZ are given in Table 1, where the concentrations are expressed in relation to normal solutions.

TABLE I.

	Concentrations with which no coagulation is produced (rising values)			Concentration with which further complete coagulation is produced.		
Chloride of mercury $HgCl_2$	0.5	– 0.00025	Normal		—	Normal
Acetic acid	0.25	– 0.125	»	0.5	– 0.25	»
Citric acid	0.05	– 0.0125	»	0.125	– 0.05	»
Sodium hydrate	about	0.0225	»	about	0.05	»
Oxalic acid	under	0.025	»	under	0.5	»
Litium chloride	0.025	– 0.0125	»	0.125	– 0.050	»
Ammonium chloride	0.025	– 0.0125	»	0.125	– 0.050	»
Chloride of sodium	0.015	– 0.0125	»	0.125	– 0.050	»
Cloride of potassium	0.025	– 0.0125	»	0.125	– 0.050	»
Rhubidium chloride	0.0125	– 0.005	»	0.050	– 0.025	»
Formic acid	0.0125	– 0.005	»	0.1	– 0.050	»
Nitrate of silver	0.005	– 0.0025	»	0.025	– 0.0125	»
Orthophosphoric acid	0.005	– 0.0025	»	0.025	– 0.005	»
Nitric acid	0.0015	– 0.0005	»	0.005	– 0.0025	»
Sulphuric acid	0.0015	– 0.0005	»	0.005	– 0.0025	»
Magnesium chloride	0.00125	– 0.0005	»	0.005	– 0.0025	»
Chloride of manganese	0.00125	– 0.0005	»	0.005	– 0.0025	»
Calcium chloride	0.00125	– 0.0005	»	0.005	– 0.0025	»
Strontium chloride	0.00125	– 0.0005	»	0.005	– 0.0025	»
Chloride of nickel	0.00125	– 0.0005	»	0.005	– 0.0025	»
Chloride of cobalt	0.00125	– 0.0005	»	0.005	– 0.0025	»
Chloride of cadmium	0.00125	– 0.0005	»	0.005	– 0.0025	»
Chloride of barium	0.00125	– 0.0005	»	0.005	– 0.0025	»
Hydrocheric acid	0.001	– 0.0005	»	0.005	– 0.0025	»
Hydroxide of calcium	0.001	– 0.0005	»	0.004	– 0.0020	»
Protochloride of copper $CuCl_2$	0.0005	– 0.00025	»	0.0025	– 0.00125	»
Perchloride of iron, $FeCl_2$	about	0.000125	»	0.0005	– 0.00025	»
Chloride of aluminium, $AlCl_2$	»	0.000125	»	about	0.00025	»

The table shows that the organic acids in general possess very weak coagulative capacity; the phosphoric acids, among the mineral acids, also possess only a weak coagulative capacity, whereas the so-called strong acids, *i. e.*, the strong dissociated mineral acids, such as sulphuric acid, nitric acid and hydrochloric acid possess a strong coagulative capacity.

Of the hydrates only the sodium and calcium hydroxides were examined. The coagulation capacity of the former is very weak (complete deposition can only be attained by a concentration of 0.5 N) whilst the latter possesses an exceptionally strong coagulative capacity ; even concentrations of 0.004 bring about complete coagulation of the clay suspension.

If we leave on one side the chloride of mercury, then the coagulative capacities of the acids stand in close association with the atomicity of the cations. The acids of the non-atomic cations produce coagulation only with relatively high concentrations ; the acids of the di-atomic cations are effective in more dilute concentrations ; but the coagulative capacity is especially strong with the tri-atomic cations — iron (12) and aluminium salts.

In addition to the investigations mentioned, Prof. GEDROIZ has examined the influence of sulphuric acid on the coagulative capacity of salts. It has been found that very weak concentrations of sulphuric acid, which of themselves can cause no coagulation of the clay suspensions, strengthen the coagulative capacity of the salts in a high degree. Such concentrations of chloride of sodium and chloride of potassium were investigated, which of themselves cause no coagulation of the clay suspensions. Thus, for example, a solution of chloride of sodium of the concentration of 0.0125 N. gave no coagulation of the clay suspensions in 48 hours, but if to the same solution sulphuric acid in the concentration of 0.001-0.000075 N. were added, then the clay suspension after 20 minutes was already flocculated and deposited. No coagulation was caused by weaker concentrations of sulphuric acid. The same result was obtained with chloride of potassium solution, with which also the concentration of chloride of potassium (0.0005 N.) by itself alone could cause no flocculation in 48 hours.

The influence of sodium hydrate on the flocculation of clay suspensions, with the presence of neutral salts in the solution at the same time, is much more complicated. With low concentrations of sodium hydrate (0.005 N.) the coagulation which was caused by higher concentration of chloride of sodium (0.15 N.) was strengthened ; the same concentration of sodium hydrate, however, with weaker concentrations of chloride of sodium, of 0.1 N. onwards, caused a noticeable retardation of coagulation. The solution of chloride of sodium of the concentration 0.015 N. caused by itself relatively great coagulation and a deposit in 48 hours. If, however, sodium

hydrate were present in the solution at the same time, then the coagulation with concentrations of sodium hydrate of 0.05-0.0125 N. could still be observed, whilst weaker concentrations of sodium hydrate (0.005-0.00025 N.) much retarded the coagulation, and only with concentrations of NaOH of 0.000025 N. was no retardation to be observed.

The soda solution exercised a still greater retarding action on the coagulation of the clay suspensions by the chloride of sodium. A concentration of 0.015 N. still caused comparatively strong coagulation, but if to this chloride of sodium solution was added soda in the concentration of 0.0125-0.00005 N., then no coagulation could be noticed.

The influence of the sodium hydrate on the flocculation brought about by chloride of potassium was the same, in the experiments of GEDROIZ, as he had shown with chloride of sodium solutions.

The influence of the sodium hydrate on the flocculating capacity of the chloride of potassium was different. The chloride of potassium solutions in the concentration of 0.001 N. in 48 hours already caused considerable coagulation, by the addition of sodium hydrate in the concentrations 0.001-0.00025 N. the coagulation was strengthsened. Coagulation was retarded by the addifion of sodium hydrate in weaker concentrations (0.000125-0.0000125 N.), but the retarding action was no longer noticed with a concentration of 0.000005 N. By the addition of sodium hydrate to a chloride of potassium solution, therefore, with weak concentrations of the sodium hydrate, the coagulation is still further strengthened, and only concentrations of sodium hydrate of 0.000125 N. retard coagulation, or exert no further influence.

In the further experiments of GEDROIZ on the influence of sodium hydrate on the coagulation of clay suspension by $Ca(OH)_2$ no retarding action was observed. GEDROIZ draws from his experiments the conclusion that coagulation is caused principally by the cation, the anion operates in an opposite direction, with which the operation of the OH' ions is especially strong. The latter is especially active in solution with mon-atomic cations, whereas the coagulation capacity of the diatomic cations (*e. g.* Ca $(OH)_2$) is stronger than the stabilised action of the OH' ions.

GEDROIZ has also investigated the coagulative capacity of NaOH, Na_2CO_3 and $NaHCO_3$, and found that the greatest coagulative

capacity of the first becomes the weakest of the last, as is seen from the following data.

	No coagulation between	Complete coogulation
$NaOH$	— 0.023 — 0.020 N.	0.100 — 0.050 N.
Na_2CO_3	— 0.05 — 0.025 »	0.125 »
$NaHCO_3$	— 0.125 — 0.05 »	0.125 »

The $NaHCO_3$ is considered by GEDROIZ as diatomic.

The influence of various calcium salts on clay suspensions was almost equally great; quick-lime had the highest coagulative capacity amongst them. The concentrations of the calcium salts, with which no coagulation was brought about (the electrolytic rising-value) were as follows :—

$CaCl_2$	0.00125	—	0.0005 N.
$Ca(NO_3)_2$	under		0.00125 »
$Ca(OH)_2$	0.001	—	0.0005 »
$CaSO_4$	under		0.000125 »
$Ca(HCO_3)_2$	»		0.00125 »

The following experiment of GEDROIZ is of interest, characterising in detail the influence of electrolytes on the coagulated clay particles. After the deposition of the coagulated particles of clay, the clear solution was poured off, and in its place pure distilled water added. If coagulation were produced by chloride of sodium, then the coagulation, by reducing the concentration of the salts, was again broken off.

If the coagulation was produced by hydrochloric acid, chloride of potassium and chloride of barium, then, by reduction of the concentration of the coagulator to such an extent that no further coagulation took place, only a small part of the coagulated particles were again made free.

If, however, the coagulation was produced by $FeCl_3$, then the coagulation could no longer be arrested, even though the liquid over the coagulated deposit were poured off 5 times and replaced with pure distilled water.

It has therefore been shown that the dispersed particles, under the influence of the mon-atomic Na' ions as coagulator, have not lost their capacity for increasing dispersiveness, that is, by reducing

the concentration of the coagulator, all the coagulated particles are again dispersed, and coagulation can therefore be made reversible.

If coagulation is brought about by the H ion (hydrochloric acid) or the diatomic cations Ca'' and Ba '', then the dispersiveness in the distilled water is indeed increased, but in a much less degree than in the first case. The influence of the triatomic cations is much greater in this respect; the coagulation can scarcely be made reversible by distilled water.

GEDROIZ further took into consideration the relations between the size of the particles and the concentration of the coagulator. With this he has established that, the finer the particles, the higher must be the concentration of the coagulator in order to bring about coagulation. However, the relations with high concentrations of the electrolytes, which in a very short time produce coagulation, are rather different — the finer particles are flocculated out with lower concentrations than the coarser particles.

Also, the concentration of the clay particles in the solution has a certain significance, coagulation takes place considerably more quickly with a higher content of dispersed particles. This condition has been observed both with high and low concentrations of electrolytes.

Prof. RAMANN (13) quotes some data on the coagulation of quartz suspensions, which unfortunately are not comparable with the data of GEDROIZ. Quick-lime has also been shown by the experiments of Prof. RAMANN to be a very quick coagulator, having caused coagulation with a concentration of 0.00035 N., that is, with a content of 0.013 gm. to the litre. The influence of quick-lime was 300 times greater than the influence of sodium oxide, and 245 times as great as the influence of carbonate of soda. Prof. RAMANN is also of the opinion that the physical qualities of the soils are in intimate relation with the coagulation phenomena.

Some data relative to the influence of $Ca(OH)_2$ on the finest particles of soil are found in the investigation of Prof. O. LEMMERMANN and L. FRESENIUS (14), in which it is shown that in weaker concentrations $Ca(OH)_2$ can also have a retarding action on the coagulation of suspensions.

The above investigations, including the exhaustive investigations of GEDROIZ, give no explanation why the physical qualities of soils, even with the podsol formation of clay soils, are so quickly altered. According to the investigations of GEDROIZ, podsol clay soils contain extremely small quantities of absorbed cations, apart from the H ion,

but the coagulation capacity of the latter is comparatively high. Moreover, it must also be assumed that a certain quantity of H ions are formed in podsol clay soils by washing out reaction, which has in fact been observed from many methods of determining the lime requirements of the soil. Even very small concentrations of H_2SO_4 of 0.000075 N. and over, have assisted coagulation in the investigations of Prof. GEDROIZ. From other investigations of Prof. GEDROIZ it has been shown that the dispersiveness of the soil is very much raised by replacing Ca '' by H '.

The properties of clay which has been exposed for a long time to the action of water are quite unexplained. It is known from practice that even the physical qualities of marl clay become very bad after the continued action of water, quite apart from loams having no $CaCO_3$, which at the same time contain the absorbed H' ions of clay-loam. GEDROIZ points out finally that water saturated with $CaCO_3$, but containing no CO_2, exerted no influence on the coagulation of the clay suspension which was obtained from the clay investigated. Theoretical considerations, however, show that if $CaCO_3$ is contained in the clay particles, with at the same time other electrolytes which assist or retard the dissociation of the $CaCO_3$, this influence must be very great

It is well known from practice that even from the poor soils of Lettland with acid reaction, very light clay suspensions can be obtained. Such soils usually require larger quantities of manure, and require manuring more often than the neutral soils, which are also associated with the properties of the finest particles of these soils and their relation to electrolytes.

I. EXPERIMENTS WITH CLAY SUSPENSIONS MADE FROM THE LOAMS OF LETTLAND.

The main object of the investigation was:

(1) To ascertain the concentrations of electrolytes which cause coagulation of the suspensions of different kinds of clay, under the influence of Na' and Ca'' salts, sulphuric acid, carbonic acid, and also various mixtures of salts.

(2) To determine in detail the association of the related clay suspensions, especially in regard to the cations absorbed.

Various causes of delay occurred, however, in carrying out the investigation, consequently it could not be carried out so completely

as was intended. As in the results obtained the influence of the acid reaction of the soil, and the importance of the calcium carbonate with regard to the phenomena of coagulation, were clearly shown, the investigation will probably be of interest to those who study soil structure.

The experiments were carried out with clay suspensions of the following soils :—

(1) Clay-loam formed under the influence of excessive wet. It contains no calcium carbonate, shows very strong acid reaction, and has very inferior physical qualities.

The three following horizons of a podsol clay soil, formed on heavy rubble-loam :

(2) Upper level *A*, of bright grey colour and strong acid reaction.

(3) Brown loam, level *B*, especially rich in the finest particles. It contains no $CaCO_3$ and has a weak acid reaction with litmus paper.

(4) Marl loam, has a feeble alkaline reaction with litmus paper. Level *C*.

(5) Suspensions of original chalk — a relatively pure $CaCO_3$ suspension.

A detailed account of the testing materials will be given below after the description of the experiments.

The particles of clay used in the experiments were obtained from air-dry soil, dried in the room, without baking, or the application of any reagents. The soil was pulverized, granulated through a 1 mm. sieve, and then various fractions of clay obtained by cleaning. First that fraction was recovered which had not been deposited in 24 hours from water 10 cc. in depth. At the same time several beakers were filled, each with 100 gm. soil and 500 cc. water, and decantation was carried out 8-10 times. From the fraction of clay obtained in this manner, particles of clay were isolated, which had not deposited from water 10 cc. in depth in the course of 72 hours. This somewhat complicated process had to be followed on account of the marl loam, as this at first supplied no portion which could be cleared of mud, and the original chalk showed the same condition. After the marl loam and original chalk had been treated longer with water, particles susceptible of being cleared of mud were obtained, which, however, deposited comparatively quickly, that is, in the course of 4-5 days. The examination of the clear liquid over the

deposited fractions of clay of this kind of soil showed that in the liquid fairly large quantities of Ca $(HCO_3)_2$ had formed, which had also caused coagulation. The experiments lasted several months. Also, the finest products of the marl loam had deposited several times during this period, and each time the clear liquid was poured off, and replaced by distilled water. The following experiment shows how great is the influence of the water, which had already been standing for a long time over the finest products of the marl loam, on the mechanical composition of the fraction of clay (finest products).

From those clay fractions of the marl loam which had not yet deposited in the course of 10 days, the clear liquid was poured off; the residue was freed from mud, and each 25 cc. pipetted three times. This volume of the clay fraction contained 2.21 gm. of dry residue. With this clay fraction, without drying it, the mechanical analysis was carried out For the analysis there were used (1) distilled water, (2) water which had stood for 10 days over the clay fraction of the marl clay, and (3) water which had stood as long as 60 days over the clay fraction and had become relatively harder.

TABLE II. — *Mechanical composition.*

	Deposits in 6 hours	Deposits in between 6-24 hours	Deposits in 24 hours
I.	21.2 %	40.4 %	38.4 %
II.	53.1 %	46.7 %	0.2 %
III.	96.2 %	3.7 %	0.1 %

It is seen that the alteration of the mechanical composition proceeds proportionately in stages—first the finest products disappear, and afterwards, when the water has become harder, the quantity of those particles which deposited in between 6-24 hours, is quickly reduced. From this test we see that the finest products of the marl clay cannot be obtained by mechanical analysis, even with distilled water, if the deposit of the products requires several days. A part of the finest products becomes no more dispersive by the use of the distilled water, since even in the first experiment 21.2 % of particles were available, which deposited in the course of 6 hours.

An analysis of the water used for experiments II and III, for its content of $Ca(HCO_3)_2$ and $NaHCO_3$ (16), showed:

II.

$Ca(HCO_3)_2$ . .	0.0009 N	0.073 gm. per litre
$NaHCO_3$ . . .	0.0002 »	0.017 » » »

III.

$Ca(HCO_3)_2$ . .	0.0015 »	0.121 » » »
$NaHCO_3$ . . .	0.0003 »	0.025 » » »

It should be remarked that $Ca(HCO_3)_2$ is reckoned as a diatomic, but $NaHCO_3$ as a mon-atomic salt, since the number of the $CO'_3{}'$ ions at the dissociation is very small, we have in the solution mainly the mon-atomic $HCO_3{}'$ anion. It is shown later that concentrations of this salt, of the amount found, can already exert considerable coagulating influence on the finest products.

The recovery of the finest products of the original chalk was also difficult. Only one out of several samples of original chalk gave such fine products that they did not deposit in the course of about 10 days, but even in this sample the deposit was complete after the expiration of 20 days, and only by the removal of the clear liquid standing over it, and the addition of fresh distilled water, was the suspension obtained again.

An attempt was also made to obtain suspensions of the finest particles from calcium precipitate. Although the mechanical composition in a few samples of chalk showed a relatively high content of the finest products, yet complete deposit in all the samples was very quick, and lasted no longer than one hour from a layer of water 15 cm. deep. A thorough examination showed that a fairly energetic hydrolytic decomposition of $CaCO_3$ takes place, and fairly large quantities of $Ca(OH)_2$ form in the solution. The concentration of $Ca(OH)_2$ was in some cases even 0.0016 N. which must also be taken as the main reason why, from $CACO_3$ precipitate, no suspension of the finest particles could be obtained. In another article I will go more closely into the question of the hydrolytic decomposition of $CaCO_3$, andespecially as to the factors which are favourable to the decomposition, and those wh ich retard it, because this phenomenon also may have great influence on the physical qualities of the soil.

The concentration of clay suspensions of the above-mentioned soils was as follows :—

(1) Loam-clay soil	4.43	gm. per litre
(2) Podsol clay soil, level A . .	2.76	» » »
(3) » » » » B . . .	1.56	» » »
(4) » » » » C . . .	3.24	» » »
(5) Original chalk	0.34	» » »

The experiments were carried out in test tubes of Jena glass. For each test 10 or 15 cc. of the suspension were used, and the same, or twice as great a volume added of the solution to be examined ; the concentration of the solution is expressed in terms of normal solutions, which occur according to the mixture of the solution with the suspension. I have not considered it important to have the concentration of the suspension equally great in all the experiments, as according to the investigations of Gedroiz, it is not the concentration of the suspension, but rather the degree of dispersiveness, which has the greatest significance.

The observations were made at short intervals during the first 9 to 8 hours, and afterwards after 24 and 28 hours. The general formation was already quite clear after 24 hours, just as in the experiments of Gedroiz, but in rare cases alterations were observed after the expiration of 24 hours. In several cases I have thoroughly shaken the tubes after 2 and several days, and repeated the observations, but very rarely found any difference. In all the experiments also, clay suspensions were used without any reagent, diluted with corresponding quantities of distilled water. In the great majority of cases two similar cylinders were used. It should be mentioned that the clay suspension, which had not deposited any particles of soil in 2 hours, after 24 hours, however, gave a small deposit at the bottom of the control cylinder. If the clay suspension is flocculated, however, even though slightly, then the deposit covers the whole of the bottom.

I shall here give only the most important results, that is, only the lowest concentrations, which produce complete flocculation in 24 hours, and the highest concentrations, which cause no flocculation (electrolytic rising value).

(1) *Sulphuric acid.*

Concentrations of 0.0001 N-0.005 N. were examined. The action was strong, the results were quite definite after 6 hours ; after 24 hours no alterations were to be observed. The suspended particles of original chalk all passed over into solution with concentrations

of sulphuric acid of 0.002 N. and higher. The results can be seen from table III

TABLE III. — *Concentration of normal sulphuric acid :*

	Complete coagulation	No coagulation
Clay suspension of Loam-clay soil	0.002 N and over	0.0005 N. and under
Podsol clay soil, Horizon A	0.002 » » »	0.0005 » » »
» » » » B .	0.001 » » »	0.0003 » » »
» » » » C	0.005 » » »	0,0001 » » »
Original chalk .	0.001 » » »	0.0003 » » »

The data quoted show that the clay suspension of the marl loam (horizon C) is especially sensitive to sulphuric acid.

The following tests were also made with the clay suspension of the loam-clay soil and the upper horizon (A) of the potter's clay soil : 10 gm. of the dry soil were mixed directly with 10 cc. of sulphuric acid of different concentrations. The concentration of sulphuric acid with which complete flocculation took place was in this case rather higher — for both soils 0.003 N. ; after 24 hours, however, the action was almost complete even with the concentration of 0.002 N. To the same cylinder, after flocculation, another 20 cc. of distilled water was added, which reduced the concentration of the acid by a third, and now began an increase of dispersiveness of the coagulated particles. In the cylinders with sulphuric acid of the concentration 0.0007 and lower, the quantity of dispersed particles was approximately the same as in the tubes with soil in distilled water. The coagulation and peptisation of the suspension is therefore a reversible process in the soils mentioned. GEDROIZ, in his investigations with hydrochloric acid, could only bring about incomplete peptisation.

(2) *Experiments with carbonic acid gas* (CO_2).

Distilled water containing 0.98 gm. CO_2 to the litre was used. If to 15 cc. of the clay suspension 15 cc. of the water containing carbonic acid were added, then the concentration of carbonic acid was 0.44 gm. to the litre, or say 0.01 N, if we assume that the CO_2 in the more dilute solution is dissociated from H'-HCO_3'. The clay suspension of the loam-clay soil and of the upper horizon (A) of the podsol clay soil gave no deposit with the 0.01 N. solution

of carbonic acid; the clay suspension of horizon B, with the same solution, gave a weak deposit, but with the concentration of 0.005 N. no deposit. The other two samples of clay suspension showed the following results :—

	Complete flocculation	No flocculation
Suspension of horizon C. of the podsol clay soil	0.001 N. and over	0.001 N. and under
Suspension of original chalk.	0.002 N. » »	0.0003 N. » »

The suspension of the finest particles of original chalk went completely into solution in this case also with concentrations which were greater than 0.0003 N. It is very characteristic that the clay suspension of the marl clay is much more sensitive to carbonic acid than the suspension of the pure original chalk. This phenomenon must be connected with the suspension — the concentration of the suspension of the marl clay was much greater.

To the cylinders with the clay suspensions of the loam-clay soil and horizons A and B of the podsol clay soil were added, after 24 hours, 0.5 gm. $CaCO_3$, as original chalk. Although the concentration of the carbonic acid had become weaker, the influence of the carbonic acid was considerably raised by this addition. With it the coagulation of the clay suspension of the loam-clay soil was almost complete, as can be seen from the following data :—

	Complete coagulation	No coagulation
Clay suspension of loam-clay soil. .	over 0.01	0.003 N. and under
» » » horizon A. .	» 0.01	0.002 N. » »
» » » » B.	» 0.004	0.0005 N. » »

10 gm. loam-clay soil and 10 gm. of the horizon A were each mixed with 1.0 gm. $CaCO_3$ in other cylinders, and distilled water without CO_2 added. The coagulation of the clay particles in this case also proceeded quickly — in six hours. After renewing the distilled water, no peptisation of the finest particles was observed.

From the experiments on the influence of distilled water containing carbonic acid, it can further be remarked that the deposit of the finest particles shows near relationship to the chalk contents of the soil: if no $CaCO_3$ is available in the soil, then either no, or an incomplete flocculation and deposit takes place. Such water can therefore be used as a reagent in the qualitative testing of the lime requirements.

It is characteristic that the concentration of carbonic acid, which produces a complete flocculation of the clay suspension of the marl-loam (0.001 N.), is only twice as low as the corresponding concentration of sulphuric acid, yet the electrolytic rising-value for both these acids is equally high (with the concentration 0.0001 N.). If we take into consideration that the carbonic acid has expelled sulphuric acid from the $CaCO_3$, then it follows from this that the action of the carbonic acid is not weaker, but stronger, than that of the sulphuric acid.

(3) *Experiments with $Ca(OH)_2$.*

The experiments were carried out with concentrations of 0.0001 N.-0.005 N. In all these experiments the results were quite definite after 6 hours, and no further differences occurred between 6-48 hours.

The following results were obtained :—

TABLE IV

	Complete flocculation	No flocculation
Clay suspension of loam-clay soil . .	0.005 N and over	0.002 N and under
" " " podsol clay soil horizon, A	0.003 "	0.005 " "
" " " " " " B	0.002 "	0.0003 " "
" " " " " " C	0.002 "	0.0005 " "
Suspension of original chalk	0.002 " "	0.0003 " "

It is surprising that with the flocculation caused by $Ca(OH)_2$ no great differences of the operating concentration could be observed, as with the other electrolytes examined. The clay suspension of horizon B is even rather more sensitive to $Ca(OH)_2$ than the clay suspension of the marl loam.

The clear liquid over the deposit in the test cylinders was almost completely poured off, and distilled water again added. The clay suspension of the loam-clay soil in this case gave no deposit at all; the deposit in all the other test tubes was fairly large, but complete flocculation only took place in the cylinders with clay suspension of marl loam and horizon B, in which the original concentration of the $Ca(OH)_2$ amounted to 0.005 N. and over. Complete peptisation, however, could not be observed in any of the soils used, except in the clay suspensions of loam-clay soil, even after the addition of larger quantities of water.

(4) *Experiments with NaOH.*

The experiments were carried out with concentrations 0.003 N.—0.5 N., and the following results were obtained:—

TABLE V.

	Complete flocculation	No flocculation
Clay suspension of loam-clay soil . . .	0.3 N and over	0.05 N and under
» » » potter's clay soil level A.	0.2 » »	0.02 » »
» » » » » » » B	0.03 » » »	0.005 » »
» » » » » » » C.	0.02 » » »	0.003 » »
» » of level C of another sample of soil	0.02 » » »	0.003 »

From the data quoted it appears that flocculation of the loam-clay soil and of horizon A of the podsol clay soil occurs with 10-15 times higher concentrations than does the flocculation of the clay suspensions of the marl loam. In order to prove the results obtained, clay suspensions of marl loam were also prepared from another sample of soil, which also proved to be equally sensitive to NaOH. It is probable that in this case the Na' ion is not of such great importance as the calcium ion passed over from the marl loam It is also characteristic that the clay suspensions of loam-clay soil with concentrations of NaOH of 0.3 N.-0.05 N., viz.: suspensions of horizon A of the podsol clay soil, of 0.2 N.-0 02 N , in other words with those concentrations with which coagulation was in no way complete, showed a graded distribution of the solid particles, with respect to which 3 to 4 stages could be distinguished. This result was not obtained with the incomplete flocculation of the clay suspensions of the marl loam.

(5) *Experiments with $NaHCO_3$.*

As already stated above, the $NaHCO_3$ is considered as a monatomic salt. The experiments were carried out with concentrations of 0.001 N.-0.5 N., and the following results were obtained —

TABLE VI.

	Complete flocculation	No flocculation
Clay suspension of loam-clay soil.	0.4 N and over	0.05 N and under
» » » horizon A .	0.3 » » »	0.01 » » »
» » » » B	0.1 » »	0.02 » » »
» » » » C . . .	0.03 » » »	0.002 » » »
» » original chalk . .	0.03 » »	0.005 » »

It may be remarked that $NaHCO_3$ acts less strongly than NaOH which is also confirmed by the experiments of GEDROIZ.

In comparing the results it must be borne in mind that the $NaHCO_3$ of Prof. GEDROIZ is assumed to be diatomic. The action of the $NaHCO_3$ is much stronger on the clay suspensions of marl loam and original chalk than on the other clay suspensions examined. The clay suspension of the loam-clay soil demands especially high concentrations for complete flocculation. After 48 hours, therefore, and the completion of the experiment, there was added to each of these clay suspensions 0.5 gm. $CaCO_3$ in a test tube. The flocculation capacity of the $NaHCO_3$ on the loam-clay suspension was not strengthened in this case, as was the case in the experiment with water containing carbonic acid. A closer examination of this phenomenon showed that the hydrolytic decomposition of the $CaCO_3$ was very much reduced by $NaHCO_3$, as both salts have the same anions.

(6) *Experiments with NaCl.*

Concentrations of 0.0005-0 5 N. were examined, and the following results obtained —

TABLE VII.

	Complete flocculation	No flocculation
Clay suspension of loam-clay soil.	0 2 N and over	0.02 N. and under
» » » horizon A.	0 2 » » »	0.005 » » »
» » » » B	0.02 » » »	0.003 » » »
» » » » C.	0.01 » » »	0.0005 » » »
» » » original chalk.	0.02 » » »	0.002 » » »

Here also the strong action of the chloride of sodium on the clay suspensions of the marl loam, and especially the great difference between the concentrations which cause complete flocculation and no flocculation, is striking. In the experiments with chloride of sodium, the deposition proceeded much more slowly than with the other electrolytes tried ; during 24-48 hours considerable alterations could still be observed, which in the clay suspensions of the loam-clay soil and horizon A of the podsol clay soil were not nearly so grealta in the clay suspension of the marl loam. The explanation of this result must be sought in the influence of the NaCl on the hydrolytic decomposition of the $CaCO_3$ and the further dissociation of the pros

ducts of this decomposition. NaCl contains no ions common to $CaCO_3$ consequently the hydrolytic decomposition of the $CaCO_3$, under the influence of the NaCl, proceeds more quickly. If $CaCO_3$ precipitate alone is added to with a chloride of sodium solution, then perceptible quantities of the $Ca(OH)_2$ in a short time go into solution according to the equation:

$$CaCO_3 + 2\ H_2O = Ca\ (OH)_2 + H_2CO_3$$

The $Ca(OH)_2$ is strongly dissociated into Ca'' and OH'; ions H_2CO_3, however, dissociates very easily into H_2O and CO_2 and only forms small quantities of ions $H' + HCO_3'$ therefore a strong alkaline reaction in the solution can be shown with phenol-phtaline as indicator, and it can be easily shown that the solution contains $Ca(OH)_2$, and only very small quantities of Na_2CO_3, $NaHCO_3$ and $Ca(HCO_3)_2$. As, however, the hydrolytic decomposition in this case belongs to the slowly-progressing reactions (heterogeneous system), then probably on this account the difference in the concentrations which produce complete and no coagulation may be dissimilar; the former concentration is about 20 times greater than the latter, which was not the case with the electrolytes observed previously. The balance, in this case, can only be established after a long time

(7) *Experiments with $CaSO_4$.*

The experiments were carried out with concentrations of 0.0003 N. -0.01 N.

TABLE VIII.

	Complete flocculation	No flocculation
Clay suspension of loam-clay soil	0.005 N. and over	0.001 N. and under
» » » horizon A of podsol clay soil	0.005	0.0005 » »
» » » » B » » »	0.003 » » »	0.0003 » » »
» » » » C » » »	0.001 » »	?
» » » original chalk . .	0.002 » » »	0,0003 » » »

The clay suspension of the marl loam, with a concentration of gypsum of 0.0003 N., in 6 hours gave no deposit; after 24 hours

there was a slight deposit, and after 48 hours a fairly heavy one. Therefore, the concentration which produces no deposit is less than 0.0003. N., probably 0.0001 N.

The lowest concentrations of gypsum, which will cause a complete flocculation of the clay suspensions, are about twice as high as the corresponding concentrations of sulphuric acid — the action of the latter is therefore stronger.

(8) *Experiments with* $Ca(HCO_3)_2$

The experiments were carried out with concentrations of 0.0001 N.-0.01 N., in which the $Ca(HCO_3)_2$ is considered as diatomic. The solution also contained free carbon dioxide — in the 0.02 N.-Ca $(HCO_3)_2$ solution moreover 0.01 N.-CO_2 — which might still further strengthen the action of the solution on the marl loam. The results were as follows :—

TABLE IX.

	Complete flocculation	No flocculation
Clay suspension of loam-clay soil .	0.005 N. and over	0.002 N. and under
» » » horizon A of podsol clay soil	0.004 »	0.0005 »
» » » » B » » » »	0.002 »	0.0003 » »
» » » » C » » »	0.0005 »	0.0001 »
» » » original chalk. .	0.002 » » »	0.0005 » »

Hence, it is seen, that the clay suspensions of the marl loam are much more sensitive to $Ca(HCO_3)_2$ than the clay suspensions of the loam-clay soil and the upper horizon of the podsol clay soil. Here also are found considerable differences in the behaviour of the clay suspension of the loam-clay soil and that of the upper horizon of the podsol clay soil — the latter is flocculated by lower concentrations of $Ca(HCO_3)_2$, but especially low are those concentrations which cause no coagulation (electrolytic rising-value).

(9) *Experiments with* $Ca(HCO_3)_2$ and $NaHCO_3$.

The analyses of numerous water extracts from various soils show that certain quantities of $Ca(HCO_3)_2$ and $NaHCO_3$ pass over into the water-extract, which is even found to be the case with very acid soils. The same salts are also found in the composition of the subsoil water. Even the so-called surface waters, for instance those flowing on the surface from woods and fields, contain certain

quantities of these salts; the $NaHCO_3$ contents are in many cases perceptibly high, possibly exceeding 0.001 N. The contents of $Ca(HCO_3)_2$ and $Mg(HCO_3)_2$ in the surface waters are always relatively small, often even considerably less than the contents of the first-named salt. These salt contents can of course influence the flocculation process, and at the same time, therefore, the physical properties of the soil also. The experiments of GEDROIZ showed that NaOH and Na_2CO_3, even in concentrations of 0.00005 N., can completely stop the flocculation produced by 0.015 N. NaCl solutions.

In the homogeneous system $Ca(HCO_3)_2 + NaHCO_3$ both salts have common anions, which strongly influences the solubility of the $Ca(HCO_3)_2$. In a 0.02 N. solution of $Ca(HCO_3)_2$, the $NaHCO_3$ in a concentration of 0.06 N., in 24 hours already causes complete deposition of the chalk $CaCO_3$; in 5 days, however, the concentration of the $Ca(HCO_3)_2$ solution is considerably reduced by even such weak solutions of $NaHCO_3$ as 0.001 normal.

The experiments with the clay suspensions were carried out with various concentrations of salts; we will therefore consider separately the experiments with the clay suspensions of one of each kind of soil.

a) Clay suspensions of loam-clay soil.

These experiments were carried out about two months later than the experiments with the $Ca(HCO_3)_2$ alone. In this time the clay suspension of the loam-clay soil had already considerably changed its properties, and had become less sensitive to $Ca(HCO_3)_2$. At the beginning of the experiments the clay suspension, with 0.003 N. solution of $Ca(HCO_3)_2$, in 24 hours gave a comparatively large deposit; at the time of carrying out the experiments about to be described, the clay suspension in 24 hours gave no deposit with a $Ca(HCO_3)_2$ solution of concentrations 0.003 N. and 0.004 N., and also no deposit when at the same time, in addition to $Ca(HCO_3)_2$, there was also present in the solution $NaHCO_3$ in concentrations of 0.000002 N. up to 0.15 N.

The clay suspension of the loam-clay soil at the commencement of the experiments gave a fairly large deposit with 0.1 and 0.2 N. solution of $NaHCO_3$.

Exhaustive experiments could not be made, on account of the lack of provision of testing material and want of time. With clay suspensions of loam-clay soil, experiments could only be carried out with the assistance at the same time of a 0.007 N. solution of

$Ca(HCO_3)_2$ and the following concentrations of $NaHCO_3$ solution: 0.01 N., 0.005 N., 0.002 N., 0.001 N., 0.0005 N., 0.0002 N., 0.0001 N., 0.000005 N., 0.000002 N., 0.000001 N., 0.0000005 N.

The deposit was complete in all the test tubes in 24 hours. Now, however, the tubes were interchanged and the observation repeated, when considerable differences in the condition of the tubes could be shown: after 40 minutes there was a fairly large deposit in the tubes with $CA(HCO_3)_2$ without $NaHCO_3$, but the deposit in all other tubes with $NaHCO_3$ was very small. The deposit after an hour was much smaller in the tubes with $NaHCO_3$ in concentrations of 0.002 N.-0.01 N., 0.0002 N.-0.0005 N. and 0.000005 N.-0.0005 N., than n the tubes with $NaHCO_3$ in the other concentrations examined io.001 N., 0.00001 N. and under 0.000005 N.) the general forma-(ion after 1 ½ hours was more uniform; although the deposit was ttill not at all complete, the deposits in the tubes with $NaHCO_3$ sn concentrations 0.01 N.-0.002 N. were notably smaller. The rep-ietition of this experiment was unfortunately not possible.

b) Clay suspensions of horizon A of the podsol clay soil.

The experiments with these clay suspensions were only carried out with $Ca(HCO_3)_2$ in the concentrations 0.003 N. and 0.007 N.

In the first series of experiments without $NaHCO_3$ coagulation was almost complete in 24 hours, as also in the experiment three months before; the properties of the clay suspensions were therefore not altered, as was the case with the clay suspensions of the loam-clay soil. The concentrations of $NaHCO_3$ which were used, were between 0.15 N. and 0.00001 N. Complete deposit after 24 hours could only be obtained with the concentrations 0.01 N.-0.002 N. of the $NaHCO_3$, there was hardly any deposit in the same time with the concentrations 0.15 N.- 0.02 N., but again almost complete deposit, similar to those without $NaHCO_3$, began to be seen with concentrations of 0.001 N. of $NaHCO_3$ and even under that strength. The concentration of $NaHCO_3$ between 0.02 N.-0.15 N. also very much retarded the coagulation; the deposit in these tubes also was very small after 72 hours. After thoroughly shaking the tubes, an interesting phenomenon was observed in the tubes with the concentration of $NaHCO_3$ of 0.01 N. After the first 24 hours the deposit in these tubes was complete; after shaking, however, the deposit in these tubes proceeded much more slowly than in the tubes with lower $NaHCO_3$ concentrations, in which deposit was by no means complete in 24 hours.

This phenomenon can be explained by the fact that 0.01 N.-$NaHCO_3$ solution considerably assists the deposit of $CaCO_3$ from the solution of $Ca(HCO_3)_2$, as I was able to prove by special experiments; the solution of the soda itself of the concentrations mentioned, on the contrary, exerts no influence at all on the coagulation of the clay suspension of horizon A. The deposit of the $CaCO_3$ from a 0.003 N.-$Ca(HCO_3)_2$ solution by a 0.01 N $NaHCO_3$ solution also progresses relatively quickly.

$NaHCO_3$ in concentrations between 0.000005 N. and 0.01 N. was tested with 0.007 N. Ca $(HCO_3)_2$ solution In all the test tubes with these concentrations the deposit was complete in 2 hours. After repeated mixing, and standing for 15 minutes, considerable differences could be observed here also: flocculation was especially small with concentrations of soda solution of 0.005 N.-0.01 N., 0.0005 N.-0.001 N. and 0.00002 N.-0.00005 N; after an hour the flocculation in nearly all the test tubes was complete and equally great.

c) Clay suspensions of horizon B of podsol clay soil

The experiments were carried out with concentrations of 0.001 N., 0.002 N. and 0.007 N. of $Ca(HCO_3)_2$ The concentrations of $NaHCO_3$ were in the first two series between 0.15 N. and 0.00001 N.

The influence of the $NaHCO_3$ was, in the first series (0.001 N. -$Ca(HCO_3)_2$ solution) as follows: The deposit was much greater in the test tubes with 0.15 N., 0.10 N. and 0.01 N. $NaHCO_3$ than in the tubes with pure $Ca(HCO_3)_2$ solution; the concentrations of 0.05 N. and 0.02 N. of $NaHCO_3$ much retarded flocculation; in all the other tubes, *i. e.*, with concentrations of $NaHCO_3$ of 0.005 N. and lower, there was, in comparison with the pure $Ca(HCO_3)_2$, solution, no influence to be observed.

In the second series the investigations were more exhaustive. After an hour a deposit could only be observed in the tubes with concentrations of $NaHCO_3$ which lay under 0.00005 N., and even in these tubes none were so great as in the test tubes without any $NaHCO_3$. The difference disappeared after 4 hours, still the deposits, in the tubes with 0.02 N., 0.05. N., 0. 10 N. and 0.15 N. — $NaHCO_3$ — solution, were notably smaller. After 72 hours the deposit was complete in all the tubes except those with 0.02 N. and 0.05 N., — $NaHCO_3$ — solution. After 72 hours all the tubes were thoroughly shaken, and after 1 ½ hours the observations were repeated. A comparatively larger deposit was present in the test tubes without NaHCO, and in

the tubes with concentrations of $NaHCO_3$ under 0.00005 N., with concentrations of $NaHCO_3$ between 0.00005 N. and 0.005 N. the deposit was small, and between the concentrations of $NaHCO_3$ of 0.005 N. and 0.15 N. there was no deposit.

In the third series, with concentrations of 0.005 N. Ca $(HCO_3)_2$, a heavy deposit began after an hour. Half an hour after shaking, it was observed that with concentrations of $NaHCO_3$ between 0.001 N.-0.01 N. and between 0.00001 N.-0.00002 N. flocculation was retarded, but after 1 hour the difference disappeared. This difference could be thoroughly investigated only by quantitative determination, which, however, is difficult to carry out.

d) Clay suspensions of marl loam (horizon C)

The experiments were carried out with concentrations of $Ca(HCO_3)_2$ of 0.0003 N., 0.001 N. and 0.007 N. The general formation was in this case still more developed than in the experiments described above. The investigation was also made more difficult because some of the clay suspensions of the marl clay change even in a solution such as $Ca(HCO_3)_2$, and therefore also $NaHCO_3$, which, in the case of experiments lasting a long time, greatly alters the general formation. It can only be said that the flocculation of the marl clay by the addition of $NaHCO_3$ is not so much retarded as was the case in the above-mentioned experiments. A most unfavourable influence on the speed of flocculation and deposit is exerted by the concentrations of $NaHCO_3$ of 0.01 N.-0.05 N. with concentrations of $Ca(HCO_3)_2$ of 0.0003 N and 0.001 N.; with concentrations of $Ca(HCO_3)_2$ there was the same effect, also some of the weak concentrations of $NaHCO_3$, but to investigate this phenomenon in detail, new and exhaustive experiments would have to be undertaken.

10. *Experiments with $CaSO_4$+$NaHCO_3$.*

These salts also react on each other by the extravasion of $CaCO_3$, and there then remains an equivalent quantity of Na_2SO_4 in the solution. This can easily be determined by the usual titration methods; the concentration of the $NaHCO_3$ becomes weaker, and there is a deposit of $CaCO_3$. The concentration of the $CaSO_4$ solution is very much reduced by the concentrations of the $NaHCO_3$ of 0.1 N., but a deposit of $CaCO_3$ is also observed with lower concentrations of $NaHCO_3$ (0.01 N.).

(a) Experiments with clay suspensions of loam-clay soil. The properties of the clay suspension of

loam-clay soil were much less altered by the solution of $CaSO_4$ than was the case with the Ca $(HCO_3)_2$ solutions. Several experimental tests showed that very small concentrations of $NaHCO_3$ greatly retarded the flocculation of the clay suspensions, even with those higher concentrations of $CaSO_4$ which cause complete deposit without the addition of $NaHCO_3$. The results are summarised in tabular form, where the degree of deposit is calculated according to the 5 grade system: 5 — complete deposit, the liquid over the solid mass is perfectly clear; 4 — almost complete deposit, the liquid over the deposit is slightly opalescent; 3 — heavy deposit, particles of clay are still contained in the liquid, the liquid is muddy; 2 — the deposit is small, the liquid very muddy; 1 — the deposit very slight; 0 — no deposit.

TABLE X. — *Concentration of 0.004 N. $CaSO_4$.*

$NaHCO_3$ normal solution	6 hours	24 hours	48 hours	72 hours
0	2	3	4	4
0.1	0	0	0	0
0.05	0	0	0	0
0.02	0	0	0	0
0.01	0	1	1	1
0.005	0	1	1	1
0.002	0	1	1	1
0.001	0	1	1	1
0.0005	0	1	1	2
0.0002	0	2	2	2
0.0001	0	3	3	3
0.00005	3	4	4	4
0.00002	3	4	4	4
0.00001	3	4	4	4
0.000005	3	4	4	4

The data quoted show that that all higher concentrations of the $NaHCO_3$ from concentrations 0.0002 onwards greatly retard flocculation, but the weaker concentrations, of 0.00005 onwards, rather hasten flocculation. The unfavourable influence was very marked of the higher concentrations of $NaHCO_3$ with which the decomposition of the $CaSO_4$ occurred by the deposit of $CaCO_3$. Thorough observations, with repeated shakings, were made with the concentration of $CaSO_4$ of 0.01 N.

TABLE XI. — *Concentration of* 0.01 *N.* $CaSO_4$.

Concentration of normal solution $NaHCO_3$	40'	1 h	4 h	20 h	First shaking	1.25 h	2 h	4 h	24 h	72 h	Second shaking	1 h	2 h	5 h
0	1	3	4	5		3	4	4	5	5		1	3	4
0.2	0	0	0	1		0	0	0	1	2		0	0	0
0.15	0	0	0	1		0	0	0	1	2		0	0	0
0.05	0	0	0	1		0	0	0	1	2		0	0	0
0.02	2	3	4	5		0	0	2	3	4		0	0	0
0.01	3	4	5	5		2	4	4	5	5		0	2	3
0.005	2	3	4	5		2	4	4	5	5		2	4	4
0.002	0	0	3	5		0	2	3	4	5		1	2	4
0.001	0	0	3	4		0	1	2	4	5		1	2	3
0.0005	0	0	3	4		0	1	2	4	5		0	1	3
0.0002	0	0	3	4		0	1	2	4	5		0	2	2
0.0001	0							(destroyed)						
0.00005	0	2	4	5		1	3	4	5	5		0	3	4
0.00002	0	1	4	5		2	4	4	5	5		0	3	4
0.00001	0	2	4	5		2	4	4	5	5		1	3	4
0.000005	0	2	4	5		2	4	4	5	5		1	3	4

The data given are obtained by simple observations, therefore a certain personal equation error is not out of the question. Without going into details, a few interesting results may be mentioned. The influence of the higher concentrations of $NaHCO_3$ was also unfavourable in these experiments, in which the deposit of $CaCO_3$ could be observed in individual experiments. The concentration of the $NaHCO_3$ of 0.02 N. is particularly interesting. At the beginning of the experiment the deposit in this tube was nearly complete in 4 hours, in 20 hours complete, but after the first shaking the deposit was by no means complete after 72 hours ; after the second shaking, however, there was no more deposit present after 5 hours. Almost the same result is seen with the concentration of $NaHCO_3$ of 0.01 N. — at the commencement this concentration, in comparison with the test tube without any $NaHCO_3$, influenced flocculation favourably, but later retarded it somewhat strongly. After the shaking , a favourable influence on the flocculation was only observed with the concentration of $NaHCO_3$ of 0.015 N., the lower concentrations exercised no influence or a negative one.

b. Clay suspensions of horizon A. — The concentration of $CaSO_4$ of 0.001 N. and the concentration of $NaHCO_3$ between 0.15 N.-0.0001 N. were investigated. An inconsiderable deposit was observed only with the concentration of the $NaHCO_3$ of 0.15 N., the other concentrations of $NaHCO_3$ investigated completely retarded the coagulation.

With the concentration of the $CaSO_4$ of 0.003 N. which by itself causes an almost complete deposit in 48 hours, the influence of the $NaHCO_3$ was somewhat different; the concentration of $NaHCO_3$ of 0.1 N. retarded flocculation; the concentrations of 0.05-0.005 N., however, assisted flocculation in the first 48 hours, but after the shaking a favourable influence was only to be observed with the concentrations of 0.005; with the other concentrations there was no influence, or a negative influence, which stands in relation to the alteration of the concentration of $CaSO_4$ by the depositing of $CaCO_0$.

All the low concentrations of $NaHCO_3$ (0.00005 N.-0.002 N.) retarded the deposit in the first 24 hours, but after 72 hours the difference was made up; a retarding influence was only to be observed with the concentrations of 0.0002 N.-0.002 N.

The concentration of $NaHCO_3$ of 0.00002 N. exerted no retarding influence.

c. Clay suspensions of horizon B. — The experiments were only carried out with $CaSO_4$ concentration of 0.001 N., which by itself gave a fairly considerable deposit in 48 hours Here also the higher concentrations of $NaHCO_3$ (0.005 N.-0.1 N.) favoured deposit in the first 48 hours; after the shaking, however, the hastening influence could only be observed with the concentrations of $NaHCO_3$ (0.0001N-0.0002 N.) exercised a markedly unfavourable influence on flocculation. With still lower concentrations of $NaHCO_3$ (0.0001 N.-0.00002 N.) no retarding influence on the coagulation was observed.

d. Clay suspensions of marl loam (horizon C). — The experiments were only carried out with a concentration of $CaSO_4$ of 0.0005 N, which by itself produces almost complete flocculation in 48 hours. The concentrations of $NaHCO_3$ used were between 0.1 N.-0.00002 N. A pronounced retarding influence was only to be observed with the concentration of $NaHCO_3$ of 0.01 N. and with that not in the first 48 hours, but only after the shaking and long standing.

CHARACTERISTICS OF THE SAMPLES OF SOIL USED FOR PRODUCING THE CLAY SUSPENSIONS.

The experiments described show that the clay suspensions of the loam-clay soil and of horizon A of the podsol clay soil are particularly insensitive to electrolytes.

The clay suspensions of horizon B show a greater sensitiveness, whilst the greatest sensitiveness is peculiar to the horizon C (marl loam). The last were even more sensitive than the clay suspensions of the original chalk, *i. e.*, the almost pure $CaCO_3$ of the highest dispersiveness. The last-named effect is probably connected with the concentration of the suspension, as in a litre about 10 times less was contained in the chalk suspension than in the suspension of the marl loam.

The retarding influence of the $NaHCO_3$ is especially great with the suspensions with $CaSO_4$ and $Ca(HCO_3)_2$, which produce no complete coagulation in 24 hours; this influence is much greater on the suspensions of the loam-clay and of horizon A than on the clay suspensions of horizon B and C. This circumstance is of especially great importance in practical agriculture. Prof. GEDROIZ, in his publications, has already pointed out several times that manuring has a very great influence on the coagulation of the finest mechanical particles of the constituents of the soil. Prof. RAMANN also, in his above-mentioned work, calls attention to the great importance of the process of flocculation, and considers it in connection with the structure of the soil.

In practice I have never observed good soils, which on mechanical analysis without preliminary preparation — baking, treating with NH_3, NaOH solutions — have given large quantities of particles which were finer than 0.01 mm. Both the soils used — loam-clay soil and horizon A of the podsol clay soil — belong to the poor, infertile soils with relatively high chalk requirement.

The podsol clay soil was more closely examined, and in the examination samples of soil were used from two neighbouring fields. The first field lay fallow in the year 1924, had received manure and 150 kg. of superphosphate per 1 ha., the other field had not been manured for four years. With the usual mechanical analysis, both the soils gave 40 % of fractions finer than 0.01 mm., and about 10 % of fractions finer than 0.001 mm., but the mechanical analysis without any preparation of the analysing materials gave the following results:

	Manured soil		Unmanured soil	
	I	II	I	II
Fractions finer than 0.01 mm	5.32 %	1 15 %	7.72 %	1.53 %
Fractions finer than 0.01 mm	0.37 %	0.07 %	0.64 %	0.14 %

The first samples of soil (I) remained 20 days under water, the second (II) were dried at room-temperature, and only had water poured on them a day before the analysis ; but on the addition of water for the second time, only very small quantities of the finest fractions were present.

In practice it is often found that soils which contain a large amount of fine clay particles require much heavier and often repeated manuring to obtain satisfactory yields.

Both the so-called productive and unproductive years are related to the flocculation and peptisation of the soil colloids. Productive years, according to the predictions of old people and the observations of practical men, are to be expected, in the zone of temperate climate, after hard winters, when the soil has been well frozen through, and after dry summers when the soil has been thoroughly dried to a great depth. Experiments I and II show how great can be the influence of drying on the quantity of finest fractions in the soil. Even very poor soils in productive years may give good results by the usual manuring, but unfortunately productive years occur very seldom.

A sufficiently high chalk content of the soil assists considerably the flocculation of the finest fractions of the soil, but cannot of itself alone produce the flocculation of these particles, since even the marl loam gave a suspension of clay particles for the experiments carried out. Practical work also shows that even the soils in the upper horizon containing $CaCO_3$, in the temperate zone, require manuring, although at greater intervals of time and in smaller doses than the poor infertile soils Also pure marl loam, which has been brought to the surface of the soil by the carrying out of large works, such as the building of roads or railways, is at first only very slowly covered with vegetation, therefore it is, in itself alone, not so fertile as might be expected. This result is connected with the finest particles of soil, which in the marl loam are not completely flocculated and may become peptonized.

In order to explain the influence of various electrolytes on the coagulation of the clay suspensions of the samples of soil examined, we must be acquainted with the genesis of these soils. The effects observed, in the temperate zone, are in close relationship with the transformation of the upper level of the soil, since formerly the upper levels in Lettland contained $CaCO_3$, and the alteration of the qualities of the finest particles could

only occur by time, with the washing out of the $CaCO_3$ from the upper levels.

The soil profiles had the following appearances.

(1) *Profile of loam-clay soil.*

The loam-clay soil was taken from a low lying marsh converted into a field.

A_1 (0-20 cm.) vegetable mould, contains 8.2 % comparatively well decomposed organic matter, reaction acid to litmus, the chalk requirement, determined according to the method of HUTCHINSON and MCLENNAN and expressed as $CaCO_3$, amounts to 0.76 %.

A_2 (20-50 cm.) grey loam, reaction acid to litmus, chalk requirement 0.21 %. In a damp state the loam is very sticky, in a dry state very hard.

B (60-70 cm.) bluish grey loam ; the physical qualities are very bad, but it reacts neutrally to litmus. From 70 cm. onwards is found typical, unstratified, stony soil.

For the experiments the upper part — 20-35 cm. — of horizon A_2 was used, in which the poor physical qualities were particularly well marked.

From the high content of organic matter and the poor physical qualities, the conclusion may be drawn that the soil has developed under the influence of excessive moisture. In this district also the subsoil water lies comparatively high, at a depth of about 80 cm. In comparison with other similar soil profiles, it must be pointed out that the horizon containing $CaCO_3$ is very deep ; usually, however, this horizon lies at lesser depths, about 20-30 cm. below the level of the vegetable mould. Probably the explanation of this appearance is that the loam horizon in this case was somewhat sandy, the content of particles finer than 0.01 mm. only amounted to 45.1 %.

In the development of the upper level of this soil the following phases can be distinguished :—

1. The whole of the $CaCO_3$ is washed out by the action of the deposit and the carbonic acid.

2. The acid reaction of the soil shows that noticeable quantities of Ca'' ions are washed out, even those absorbed in the organic and mineral matter. At the same time, the quantity of salts in the ground water is reduced, which in its turn might increase the dispersiveness of the finest particles of soil.

3. The small salt-content of the water, and the high degree

of dispersiveness of the finest particles of soil, have hastened the transformation of the sodium and calcium silicate. In the zeolitic class of products there appeared at the same time larger quantities of K' and Na' ions, which would exercise a deteriorating influence on the zeolitic products, especially in the case where no Ca'' ions are contained in the solution, which could reduce this injurious influence.

A complete chemical analysis of the loam and its suspensions could not be made.

The following quantities of CaO were dissolved in hot 10 % hydrochloric acid :—

A_1 0-15 cm.	0.571 %
A_2 20-35 cm.	0.224 %
B_1 60-70 cm.	0.414 %
C_1 70-80 cm.	1.420 %

The chalk contents of the upper level were obviously inadequate for obtaining a neutral reaction of the soil. The chalk contents of level A_1 are fairly high, but the contents of organic matter of the same horizon are also high ; for the saturation of this matter considerable quantities of Ca'' are necessary.

A few more details are given relative to the contents of K_2O and Na_2O, which may be of great importance in explaining the properties of the loam-clay soil :

	K_2O	Na_2O
Dissolved in hot 10 % hydrochloric acid .	0.240 %	0.055 %
" cold 0.05 N. " .	0.012 %	0.012 %
" 1 litre $Ca(HCO_3)_2$ solution from 100 gm. soil	0.0020 gm.	0.0016 gm.
" 1 litre clay suspension deposited by $Ca(HCO_3)_2$.	0.0060 gm.	0.0085 gm.

It must be pointed out that considerable quantities of K_2O are dissolved from hot 10 % hydrochloric acid solutions, although the loamclay soils always require much potash manuring.

According to Prof. GEDROIZ, the quantities of K_2O qnd Na_2O dissolved by cold 0.05 N. hydrochloric acid may be taken as suitable zeolitic bases for exchanging with other cations. The quantities of Na_2O found are small in comparison with the corresponding quantities from salt soils ; if, however, these are exchangeable in solution, particularly as $NaHCO_3$, then they can without doubt deteriorate the

physical qualities of the soil and the development of the plants. This effect is frequently observed in agricultural practice when applying lime to stiff soils, and also in plant growth experiments (17).

The quantities of exchangeable K_2O and Na_2O in a litre of 0.02 N.-$Ca(HCO_3)_2$ solution on filtration through a thin (1 cm.) layer of soil, are small, but the concentration of the solution reaches about 0.0001 N., which is sufficient to exercise a retarding influence on the flocculation of the clay suspensions. The same experiments have been repeated with other loam-clay soils, and it has been shown that the amount of K_2O exchanged from very poor loam-clay soils is 10 times greater, but the quantities of Na_2O 5 times greater.

It would have been of special interest to determine the quantities of K_2O and Na_2O in the liquid of the clay suspension, especially because it had an acid reaction to litmus Until now I have not been able to do this, as the liquid could not be separated from the clay particles, I have, however, determined those quantities of K_2O and Na_2O which were contained in the liquid after deposit of the clay particles with small amounts of $Ca(HCO_3)_2$, as a part of the K' and Na' absorbed in the clay particles could pass over into the liquid. This experiment gave considerable quantities in 1 litre of the liquid . K_2O — 0.0060 gm. and Na_2O — 0.0085 gm.

The clay suspension contained 4.43 gm. of clay particles in 1 litre and the percentage content of the clay particles was K_2O — 0.14 and Na_2O — 0.19 %, which are noticeable amounts and are characteristic of soils containing alkaline salts (salt soils) With regard to the details given, it must be remarked that the clay suspension was kept in a glass vessel for about 3 months, and during this time some K_2O and Na_2O might pass into solution from the glass, consequently the data obtained may contain a slight error. It seems probable that fairly large amounts of the mon-atomic cations might be found in distilled water or rain water after it has remained for a few months in glass vessels As, however, equally large amounts of the same cations are found in other soils which have been examined, it may be assumed that if the amount found is not quite accurate, it is very near to the actual value. This investigation, however, will be repeated, when the tests will be carried out in glass vessels lined with lacquer.

The investigations carried out justify the conclusion that *the finest fractions of the loam-clay soil must not only be assumed to be unsaturated, i. e., requiring a greater or lesser amount of lime (containing H' ions), but also contain absorbed K' and Na' ions : the same must*

also be considered as amongst the most important factors, which raise the degree of dispersiveness of these soils, and reduce the sensitiveness of the clay suspensions of these soils to electrolytes.

It must also be pointed out that by treating the sample 4-5 times with 1.0 N. NaCl solution, by which the Na' contents of the zeolitic products are increased, the dispersiveness of the loam-clay soil can be considerably raised, although the loam-clay soil, even after such treatment, has an acid reaction to litmus paper. After the washing out of the NaCl, the loam-clay soil gives a much greater quantity of clay suspension.

In the case of a sample of soil from the Kubanj district (Caucasus), after treatment with NaCl solution, and after washing out this solution, Prof. GEDROIZ was successful in reducing almost 50 % of the original weight of the soil in colloidal solution (18) (the diameter of the particles was less than 0.28 μ).

2. *The section of the podsol clay soil.*

The following horizons can be differentiated in the soil section.

$A_1 + A_2$ (0-18 cm.) Upper horizon much metamorphosed, of bright grey colour, the content of slightly decomposed organfic matter amounts to 2.52 %, it has an acid reaction to litmus paper.

B_1 (18-22 cm.) Loam of yellow colour with very poor physical properties ; acid reaction.

B_2 (22-52 cm.) Brown loam containing no $CaCO_3$, and which after being well dried splits up into sharp fragments ; when dry, it is firm, when damp, sticky ; weak acid reaction.

C (52 cm.) Stony unstratified loam with 16.2 % $CaCO_3$ (The $MgCO_3$ is also reckoned as $CaCO_3$).

In the experiments the horizons $A_1 + A_2$, B_2 and C were used, which are described briefly as A, B and C.

The mechanical composition of the soil, passed through a 1 mm. sieve, was as follows :—

TABLE XII. — *Mechanical Composition of Podsol Soils.*

Description	Coarse particles	A	B	C
	mm.	%	%	%
Coarse sand	1 − 0.25	3.43	3.25	6.13
Fine sand	0.25 − 0.05	34.30	32.70	42.34
Coarse silt	0.05 − 0.01	23.54	11.66	14.03
Medium silt	0.01 − 0.005	21.70	10.15	17.11
Fine silt	0.005 − 0.001	6.45	8.87	5.76
Clay particles	0.001	10.58	24.36	14.63

The samples of soil were prepared for the mechanical analysis by drying in the oven, a few drops of ammonia being added. The content of fractions coarser than 1 mm., in the levels named, were as follows :

A	B	C
20.1 %	6.6 %	17.2 %

The coarser fractions of the first two horizons consisted of particles of the primary rock, those of the last horizon, however, in addition to the primary rock contained large quantities of limestone of the Silurian formation, and some dolomite, presumably of the Devonian formation. It is seen from the mechanical composition that the upper horizon A has not only lost all the $CaCO_3$, but also large quantities of the finest fractions (clay particles), which were washed out and collected in horizon B.

The lime requirement according to HUTCHINSON, as $CaCO_3$, and the quantity of CaO released from hot 10 % hydrochloric acid, were as follows :—

	Level A	Level B.
Lime requirement as $CaCO_3$	0.25 %	0.16 %
Lime content CaO	0.069 %	0.930 %

Although the CaO content of horizon B is high, the clay suspensions of this horizon, a few hours after the production of the suspension, showed a distinct acid reaction, but after standing for about 3 months the concentration became neutral. It may be assumed that in this time a certain quantity of cations had become separated from the silicates, which altered the reaction.

The total content of K_2O and Na_2O were only determined in the marl loam (horizon C) and in the fraction of the mechanical analysis of the sample :—

TABLE XIII. — *K_2O content of Marl Loam.*

		K_2O %	Na_2O %
Marl clay	—	2.28	0.77
Fractions of marl loam	1 — 0.25 mm.	1.28	0.73
» » »	0.25 — 0.05 » »	1.22	0.74
» » »	0.05 — 0.01 » »	2.67	0.60
» » »	0.01 — 0.005 » »	4.58	1.32
» » »	0.005 - 0.001 » »	4.60	0.73
» » »	< 0.001 » »	3.60	0.10 (19)

The data given show that the silicates with specially high contents of the cations mentioned are contained in the comparatively coarse fractions (0.01-0.001 mm.); in the finest fractions they are present in much smaller quantities.

Fractions given as finer than 0.001 mm. are those products which did not deposit from a bed of water 10 cm. deep in 10 hours. In the tests clay particles were used which had not deposited in the course of 3 days. The content of K_2O and Na_2O of these particles has not been determined. Here also, as with the loam-clay soil, the amounts of K_2O and Na_2O were determined which, (I) were set free from hot 10 % hydrochloric acid; (II) from cold 0.05 N. hydrochloric acid, (III) set free in 1 litre of 0.02 N. $Ca(HCO_3)_2$ solution by filtering the solution through 100 gm. soil in a layer 1 cm. thick (the filtration lasted 48 hours); (IV) were contained in 1 litre of the solution with the clay particles which were to be examined. The determination gave the following results:

TABLE XIV. *Estimation of K_2O and Na_2O in Marl Loam.*

	A		B		C	
	K_2O	Na_2O	K_2O	Na_2O	K_2O	Na_2O
I	0.165 %	0.021 %	0.555 %	0.050 %	0.390 %	0.150 %
II	0.010 %	0.013 %	0.015 %	0.019 %	0.019 %	0.021 %
III	0.0026 gm	0.0042 gm.	0.0042 gm.	0.0043 gm.	0.0038 gm.	0.0085 gm.
IV.	0.0070 gm	0.0030 gm.	0.0040 gm.	0.0110 gm.	0.0030 gm.	0.0080 gm.

An especially large quantity of potash soluble in hot 10 % hydrochloric acid is contained in horizon B, about 3 times as much as in horizon A. Cold 0.05 N. hydrochloric acid also only dissolves small quantities of the cations mentioned from this soil, but considerably more from the marl loam than from the upper levels. Considerably smaller quantities of these cations are abstracted in the $Ca(HCO_3)_2$ solution. For the last determinations, IV, the clay particles of horizons A and B had to be flocculated with the smallest possible quantities of $Ca(HCO_3)_2$, which could, however, take over in solution a part of the K_2O and Na_2O absorbed by the clay particles. Here the especially high content of K_2O of the clay particles of horizon A is striking, but the Na_2O content is very small. The highest Na_2O content is observed in the clay particles of horizon B — 0.0110 gm. to the litre.

It must also be pointed out that the amount of K_2O and Na_2O

passed over in solution from the clay particles of the marl loam are very near to the content of these compounds in the subsoil water; even in the subsoil water are found in 1 litre about 0.0022-0.026 gm. of K_2O and 0.0060-0.0087 gm. of Na_2O, if the subsoil water contains Cl' and SO_4''.

If the figures of the last group (IV) are calculated on the content of the clay particles to the litre even higher figures are obtained.

		A	B	C
Weight of clay particles per litre		2.76 gm.	1.56 gm.	3.24 gm.
Content of clay particles in	K_2O	0.26 ⅓	0.26 %	0.09 %
	Na_2O	0.11 %	0.65 %	0.25 %

These figures may perhaps be too high, since a certain amount of mon-atomic cations might have passed over into the solution from the glass vessels in which the clay suspensions had been stored for about 3 months before the tests. Still, the relatively great differences which were found in the contents of these cations in the different horizons, show that this error cannot be very great If the content of K_2O and Na_2O in the clay particles is so high, then they stand very near to the alkaline salt soils, that is, the finest particles of the soil contain K' and Na' ions which may exert an injurious influence on the physical qualities of the soil. It has been pointed out that the physical qualitites of the marl loam cannot be considered as good, although the chalk content of the marl loam is high. The content of $CaCO_3$, however, increases the sensitiveness of the finest fractions of the marl loam to the ordinary elctrolytes examined, and also to the solution of CO_2 in water.

These experiments also afford an explanation of the phenomenon that the soil requires no dung manuring after liming, the finest fractions of the soil, after liming, are flocculated with very small quantities of salt, the clay particles of the upper horizon are not so easily peptonised and the pores of the soil are not so easily stopped up by percolation of the deposits through them, the air can therefore penetrate more easily even to the deepest levels, in which the roots of the plants can more easily develop.

As regards the injurious influence of liming, in addition to the experiments of P. Kossowitsch and L. Althausen quoted above, there may be mentioned the experiments of Gedroiz (20), according to whom the injurious influence of heavy liming can be considerably reduced by carbon dioxide in the plant vessels or by supplying the

plants with water containing carbonic acid. By such treatment the Na_2CO_3 is converted into $NaHCO_3$, which has a less injurious effect on the plants. The following sample of loam-clay soil from the neighbourhood of Hasenpoth in Latvia shows that the strong acid soils really contain considerable quantities of absorbed mon-atomic cations :

	K_2O	Na_2O
Dissolved in hot 10 % hydrochloric acid .	0.500 %	0.105 %
» » cold 0.05 N. hydrochloric acid	0.019 %	0.032 %
» from 100 gm soil in 1 litre of 0.02 N $Ca(HCO_3)_2$ solution.	0.0108 gm.	0.0175 gm.

In the district mentioned it is found that the liming of similar soils has an injurious effect, although the lime requirements of the soil are very high -- 0.34 % as $CaCO_3$. With this loam-clay soil thorough tests were made as to the permeability of water, and in some cases was found in the percolating water not only $NaHCO_3$, but also Na_2CO_3. This experiment will be more closely considered in a special treatise.

3. *Characteristics of the original chalk.*

The original chalk, from which the suspensions of the finest particles were obtained for the experiments, differs considerably from other original or field chalk, since on thorough drying no loose chalk is obtained, but fairly hard pieces. It contains no coarse crystalline $CaCO_3$ and hardly any organic matter. On filtering a 0.02 N. $Ca(HCO_3)_2$ solution through this lime, from 1 litre was obtained 0.0054 gm. K_2O, and no Na_2O.

The suspensions of the finest particles of this sample of lime were deposited completely in about 10 days, as fairly large quantities of $Ca(HCO_3)_2$ passed over into the solution ; if, however, the solution was replaced by distilled water, then the dispersiveness of the finest products was increased, and a suspension again obtained.

General Conclusions.

We will not consider here Freundlich's theory concerning the general laws of the flocculation of negative suspensions, concerning which much has already been written in the treatises of the above-mentioned author, and which Hager G. (21) treats exhaustively in

a recently published treatise ; attention will be drawn only to the most important factors, which as can be concluded from the experiments quoted, reduce or increase the influence of electrolytes of the flocculation of clay suspensions.

Very great importance is attached to those cations which are absorbed by the finest products, and which can pass into solution by diffusion ; this can very greatly alter the sensitiveness of the suspension to different electrolytes. It also explains why the clay suspension of soils with high lime requirements are much (about 10 times) less sensitive to all the Na' compounds examined than are the clay suspensions of marl loam.

If those concentrations of the electrolytes examined are compared which produce complete flocculation of the clay suspensions of the marl loam and of the loam-clay soil, then the difference between these concentrations is least with $Ca(OH)_2$-0.002 N. and 0.005 N. The explanation is probably to be sought in the properties of the $Ca(OH)_2$: first, the dissolving out of the Ca'' from the marl loam, and secondly the solution of the K_2O and Na_2O, are delayed, as was shown by Prof. O. LEMMERMANN and L. FRESENIUS (22) in a number of experiments. By the influence of the $Ca(OH)_2$ the differences in the properties of both clay suspensions were compensated for.

The greatest difference to be recorded in the behaviour of the two clay suspensions mentioned is with regard to NaCl (20 times) and against NaOH (15 times). This result can be explained, as the clay suspensions of the loam-clay soil, having a high lime requirement, could not yield a great amount of Ca'' ions to the solution, whilst the clay suspensions of the marl loam yielded considerable amounts of these ions, at all events under the action of the NaCl solution, which moreover assisted the hydrolytic decomposition of the $CaCO_3$. A specially great difference is also to be noted in those concentrations of NaCl solution which produce no further flocculation; with the clay suspensions of the loam-clay soil this is a 0.02 N. solution, whereas with the clay suspensions of the marl loam it is a 0.00005 N. solution, the difference being, therefore, 40 times as great.

An important factor also is the hydrolytic decomposition of the combined silicates ; the cations which become free by this decomposition will influence flocculation. That such hydrolytic decomposition occurs has been shown, with the clay suspensions of horizon B, which at the beginning had an acid reaction against litmus paper, but after some time became neutral. The acid soils requiring lime

differ in this respect from the neutral soils. The composition of the upper horizon of the podsol clay soil, in which the content of Na_2O is noticeably reduced, already points to this. Also the disintegrated layer of the primary rock loses very much of its Na_2O in acid soils, whereas in neutral soils the primary rock shows no disintegrated layer. The brown-coloured forest water also has a fairly high content of Na_2O although it has an acid reaction to litmus paper. All these results point to the fact that with insufficient chalk content, fairly large quantities of Na_2O pass over into solution, which can influence the properties of the suspensions of the finest articles.

I would also point out that the retarding effect of $NaHCO_3$ on the coagulation of the suspensions is especially great in those cases where the soil requires lime. Usually the explanation of the retarding effect of the $NaHCO_3$ is that this compound is dissolved in the solution with the formation of Na_2CO_3 which is hydrolytically decomposed into the strongly dissociated NaOH and the weakly dissociated carbonic acid, which latter further decomposes into H_2O + CO_2 ; OH' ions are also formed in the solution, and these have a stabilizing action on the suspensions. This explanation may be correct in those cases where Na_2CO_3 and higher concentrations of $NaHCO_3$ are used which, after some time have an alkaline reaction. The lower concentrations of the $NaHCO_3$, below 0.002 N. however, after a few days show no alkaline reaction against phenolphtaline, whilst the stabilizing influence of the $NaHCO_3$ is observed in much more dilute solutions.

In this case the explanation must probably be sought in the intermingling reaction between the $NaHCO_3$ solution and the clay suspension. If the clay suspension contains absorbed H' ions which are capable of intermingling with Na' ions, then the dispersiveness of the suspension, according to the investigations of GEDROIZ, is considerably increased, the H' ions pass over into the solution, where, with the HCO_3 ions, they form H_2O and CO_2. I have already mentioned above that, according to the investigations of GEDROIZ, the suspensions of higher dispersiveness are only flocculated by higher concentrations of electrolytes. That is probably also the chief reason why the action of the $NaHCO_3$ solution is comparatively small on the clay suspensions of the marl loam, and the action of this solution is equally small on the clay suspensions of acid soils when at the same time they are under the influence of higher concentrations of Ca $(HCO_3)_2$ and $CaSO_4$.

The second negative quality of the $NaHCO_3$ is that it retards the solution of the $Ca(HCO_3)_2$, as both these compounds have the same anion, and it assists the deposition of the $CaCO_3$ from the solutions of $Ca(HCO_3)_2$. This effect is shown by concentrations of $NaHCO_3$ of 0.0005 N., which may often be found in the ordinary soils, but which must not be included amongst the alkaline soils. That is also one of the reasons why, in determining the lime requirement of soils in accordance with the method of HUTCHINSON and McLENNAN, in many cases even marl loam shows an acid reaction.

Higher concentrations of $NaHCO_3$ of 0.01 N. and over also assist the decomposition of the $CaSO_4$, to which I have already drawn attention above. The properties mentioned of the $NaHCO_3$ may have a retarding influence on the flocculation of the clay suspensions both of acid and of neutral soils. Larger amounts of $CaSO_4$ counteract this retarding influence, since in these cases Na_2SO_4 is formed instead of $NaHCO_3$.

These experiments point to the very great importance of lime in agricultural practice, in districts in which the amount of rainfall exceeds the evaporation, and from which, therefore, a certain amount of electrolytes, and amongst others Ca'', is removed from the upper level of the soil and carried into the lower levels. When the soil has a high content of lime, carbonic acid possesses almost the same properties as sulphuric acid, consequently in these cases the carbonic acid set free from the roots of the plants can cause flocculation of the finest particles of the soil, and improve its physical qualities provided no other factors have a retarding influence on the development of the plants. If, however, the lime content of the soil is not great, then gypsum may become of considerable importance, as $CaSO_4$, in comparatively small concentrations, can cause flocculation of the finest particles of the soil. Very great importance is attached to the external morphological characteristics of the soil, which have already been noticeable when considering the soil profile of the podsol clay soil. By means of these characteristics, and without a close chemical examination of the soil, the processes in the development of the soil may be estimated and the necessary improvements may also be foreseen which must be carried out in order, according to Prof. RAMANN (23), to place the land in a good, healthy condition.

F. WITYN.

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(11) H., FREUNDLICH. Kapillarchemie. Leipzig, p. 345. 1909.

(12) In higher concentrations the $FeCl_3$ gives the so-called irregular series; betwen the concentrations 0.01-0.0025 N. no flocculation occurs; between 1.0-0.025 N., however, the flocculation is slight. With $AlCl_3$ this effect is not seen.

(13) RAMANN. Die chemisch physikalischen Wirkungen von Aetzkalk und kohlensaurem Kalk in Mineralböden. (The chemical-physical effect of quicklime and carbonate of lime on mineral soils), *Zeitschr. f. Pflanzenernähr. u. Düngung*, Vol. III, Part 4. 1924.

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(15) GEDROIZ. *Russ. Journ. f. experim. Landwirtschaf*, p. 181, 1914; pp. 1-24, 1923.

(16) The determination was made in such a way, that by titration of 100 cc. of the liquid with 0.1 N. sulphuric acid the sum of $Ca(HCO_3)_2 - NaHCO_3$ was obtained. 100 cc. was passed into a second portion of the same liquid, in which the $Ca(HCO_3)_2$ deposit, and $NaHCO_3$ was estimated by titration. The $MgCO_3$ which may also be contained in the liquid, is

estimated as $Ca(HCO_3)_2$ and the $KHCO_3$ as $NaHCO_3$; in the titration methyl orange was used as indicator

(17) P., KOSSOWITSCH Arbeiten des landw. chem. Labor. in Petersburg. Part 1905. L ALTHAUSEN, *ibidem*, Part VI 1909

(18) *Rus Journ. f experim Landwirtschaft*, pp. 27-48 1923

(19) These figures are actually greater, as in the chemical analysis NH_3 on the deposition of the clay particles (> 0.001 mm) was replaced by KAl $(SO_4)_2$, which could reduce the contents of mon-atomic cations in the clay particles

(20 *Russ Journ f. experim Landwirtschaft*, pp 705-720 1905.

(21) G. HAGER. Bodenstruktur und Kolloidchemie (Soil structure and colloidal chemistry). *Zeitschrift f Pflanzenernahr u Dungung* Part II, pp. 292-311. 1923

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Abstracts and Literature.

Soil Physics.

The Preliminary Treatment of Soils with Ammonia before an Atterberg Slime Analysis.

BLANCK, E and ALTEN, F Ein Beitrag zur Frage nach der Vorbehandlung der Boden mit Ammoniak fur die Atterberg Schlammanalyse *Journal für Landwirtschaft*, Vol 72, No 3, p 152, 1924.

The method recommended by H. KAPPEN of heating all soils, which are suspected of having been influenced by absorbed iron hydroxide or aluminium hydroxide, on the waterbath with 25 % ammonia, before carrying out an ATTERBERG slime analysis, cannot be recommended by the authors unreservedly for all soils in view of their experience.

NIKLAS.

Soil Chemistry.

Base Exchange in Soils.

A general discussion held by the Faraday Society, December 1924.

The separate subjects, reprinted in this book, have been already dealt with in separate abstracts in this journal. The book is composed of the following papers.

HISSINK, D. J. Introductory paper.

COMBER, N. M. The role of electro-negative ions in the reactions between soils and electrolytes.

PAGE, H. J. and WILLIAMS, W. Studies on base exchange in Rothamsted soils.

ROBINSON, G. W. and WILLAMS, R. Base exchange in relation to the problems of soil acidity.

SAINT, S. J. The relation between the P_H, the lime requirement, and the thiocyanate colour of soils.

FISHER, E. A. Base exchange in relation to adsorption.

FISHER, E. A. Base exchange in relation to swelling of soil colloids General discussion.

L. G.

Estimation of Titanium in Minerals, Ores and Industrial Products.

BARNEBY, O. L. and ISHAN, R. M. *Zeitschrift fur analytische Chemie*, Vol. 65, No. 9, 1925.

The paper deals with the gravimetric, volumetric and colorimetric methods for the estimation of titanium in different substances, as suggested by various authors, and quotes the corresponding literature.

NIKLAS.

An Inquiry on Liming and into the Best Means of Extending the Practice.

Enquête sur le chaulage et les moyens propres à developper la pratique de cet amendement. *Bulletin de l'Office de Renseignements agricoles*, Ministère de l'Agriculture. Paris, August, 1925.

VIII Region: South

Two parts: East of the Rhône (Cévennes). West of the Rhône (Provence).

A. *Cévennes and Languedoc.*

Ardèche Department: Consists on its central massive of granitic, Jurassic, Cretaceous and volcanic beds, and has large valleys running down to the Rhône.

Important lime-burning kilns exist at Teil and at Viviers, but, very little liming is done in the Vivarais.

Gard Department: The granite Cévennes are the home of the calcifuge chestnut-trees. On descending into the valleys alluvium is found; Gardons, Cèze are poor in lime, but quite fertile notwithstanding.

The Pliocene deposits in the South of the department are completely lacking in lime. Despite this the practice of liming is very much neglected in this vine-growing department.

Aude Department: the tertiary calcareous strata are neither vine-growing nor limed. They do not lime regularly, in this district, because it requires about 1500-2000 kgs. per hectare every 4-5 years for the granites, schists and mica-schists of the Black Mountains.

Department of the Pyrénées. East: the soils are of very varied composition, and the practice of liming is neglected.

B. *Provence.*

Vaucluse Department. Entirely calcareous.

Department Bouches-du-Rhône. Generally rich in limes, nearly 20-25 % in the alluvium of the Rhône.

Only the stony plain of Crau (diluvium) is lacking in lime. But it is not intensively cultivated except the parts irrigated by the water of the Durance, which also contains lime.

The magnesian lime (dolomite) and calcium cyanamide give good results in the Durance valley.

Drôme Department: only a small portion is granitic, the rest is sufficiently calcareous. Except on the molasse or Pliocene plateau often clayey and in the low valleys of the Drôme, Valloire, Galaure, Bancel, Herbasse and Isère, the practice of liming is neglected.

Basses-Alpes Department: the cultivated areas are generally provided with sufficient lime.

Var Department: there is a lack of lime in the Maure and the Esterel massives. The scarcity of manure causes liming to "scorch" the soil. The lime-kilns are disappearing.

In the market-gardens of Hyères basic slag is used.

Alpes-Maritimes Department: No liming is done. To the east of Cannes the granite-triassic massive is planted with the calcifuge mimosa bushes. The soils all over the department are sufficiently calcareous for the cultivation of flowers or for large-scale farming, which is not carried out beyond the tertiary marl plateau or in the alpine valleys.

Corsica.

Nearly all districts are deficient in lime. Everywhere liming is so far no more than an experiment.

It must be added that under the Mediterranean climate the practice of liming is generally neglected; in humid climates, however, lime supplements the sun and helps nitrification. PIERRE LARUE.

Methods of Estimation of Humus in Soil.

COLLINS, O. *Engelhardtsche Versuchsstation* No 2.

The application of ISCHTSCHEREKOFF's method of humus estimation in soils in the agrochemical laboratory of the ENGELHARDT experimental station did not yield accurate results. Better results were obtained by using 1-2 grams of soil instead of 0.5 gram. for an analysis and heating this to boiling point with 50 cc. of water and 20-25 cc. of 10 % sulphuric acid. To this is then added the required quantity of potassium permanganate and the whole is boiled for an hour. The humus content of a soil can be estimated with great accuracy by heating the soil with permanganate and sulphuric acid and absorbing the evolved carbon dioxide by means of caustic potash. The mixture of caustic potash and soda is analysed by WINKLER's method. AUTHOR.

Manual of Mineralogical Chemistry.

DOELTER, C. and LEITMEIER, H. *Handbuch der Mineralchemie.* With many illustrations, tables and diagrams. Four volumes. THEODOR STEINKOPFF, Dresden and Leipzig, 1925.

This already reviewed and well known work is continued with the two volumes now published. Vol. II, 11 (iron ores) and Vol. IV, 2 (copper and iron sulphides, silver sulphide, ores and tetrahedrite).

SCH.

The Estimation of the Very Small Quantities of Iodine.

FELLENBERG, v. Th. Die Bestimmung Kleinster Mengen Jod. *Zeitschrift für analytische Chemie,* Vol 65 (1925), No. 8, pp. 326-332.

The author who studied the occurrence of minute quantities of iodine in nature and the question of iodine metabolism in general at the request of the Swiss Crop Commission, gives in this paper a number of methods which can be used in estimating very small quantities of iodine, as they are found almost everywhere. Quantities from 0.01 gm. to the 10 millionth part of a gram can be estimated. The author deals with the quantitative estimation, the colorimetric estimation, the separation of organically and inorganically combined iodine, as for example iodine in water (sea-water) in salts (rock salt) in minerals, in soils, in plant and in animal substances, etc. He also investigates the content of iodine in the case of iodised salts. For further particulars see *Biochem. Ztschrft, 142,* 246 (1923), *152,* 116, 128, 132, 135, 141, 153, 172, 185 (1924). *Mitt. Lebensmitteluntersuchung u. Hyg*, *14*, 161, 305 (1923); *14*, 185 (1923). *Biochem. Ztschrift, 152,* 116 (1924).

NIKLAS.

The Determination of the Cations found Adsorbed in Soils by the Hydrochloric Acid Method.

GEDROIZ, K. Die Bestimmung der im Boden in adsorbiertem Zustande befindlichen Kationen nach der Salzsaurmethode. *Journal f. Experim. Agronomie,* 1924.

I worked out a method for the determination of the cations found adsorbed in the organic and inorganic parts of the soil, namely by their displacement by the ammonium ion from ammonium chloride (see my work in *Journal Experim. Agronomie,* vol. XIX, (1918), p. 226). As the result of further experimental work a new method is now proposed which by using cold hydrochloric acid of low concentration is not only much simpler and much more convenient than the former one, but what is also of great importance, much cheaper. This new method is based on the observation that, on treating a soil with hydrochloric acid of concentration not higher than 0.05 N., an exchange of cations takes place between the hydrochloric acid and the zeoliths of the soil, but there is no dissolving.

The course of an analysis with this method is as follows: The soil sample (5-25 gms. according to its content of adsorbed bases and the completeness of the analysis) is treated in the cold with 25-50 cc. of 0.05. HCl (special accuracy is not required) in a porcelain basin of moderate size, then filtered through a filter paper (hardness 602) and washed with the same acid until the washings show a negative tests for calcium. The filtrate is then treated in the manner usual for hydrochloric acid extracts. AUTHOR.

The Ultramechanical Composition of the Soil and its Dependance upon the Adsorption of its Occurring Cations. Liming as a Means of Improving the Ultramechanical Composition of the Soil.

GEDROIZ, K. Die ultramechische Zusammensetzung des Bodens und ihre Abhängigkeit von der Art des im Boden in adsorbiertem Zustande befindlichen Kations. *Journal f. Experim Agronomie*, 1924.

In a previous paper the author has shown that the colloid nature of a soil, as estimated by its swelling, is in close relation to the adsorption of its cation. In this paper an account is given of experimental work which proves that the mechanical and especially the ultramechanical composition of a soil (the fraction $<$ 0.001 mm.) is changed according to which cation saturates the adsorption complex of a soil. Investigations were carried out with reference to the action of Na, NH_4, K, Mg, Ba, Al, Fe and H in replacing the naturally adsorbed bases (Ca and Mg).

All soils investigated by the anthor which contained as adsorbed bases only Ca and Mg, and even the most loamy types of soil, did not show the presence of particles of colloidal size (0.25 micron); and even after the application of methods recommended for the preparation of soils for mechanical analysis the soils did not show more than 1 % of such particles. The substitution of the adsorbed Ca and Mg by the cations of Mg, H, K, NH_4 and Na increased the number of colloidal particles present in the order indicated, i. e. least on substitution by Mg and most on substitution of Ca and Mg by Na. The supplying of the soil with the cations of Ba, Al or Te on the other hand decreased the number of these colloidal particles. The author deals very exhaustively with the question of pentration of Na and H cations into the adsorbed soil complex and the influence of that penetration mainly in view of the occurrence of such penetration in nature (alkaline soils or solonetz, which contain adsorbed Na by unsaturated bases, podsol soils which contain H). The aggregates of colloidal soil particles (secondary particles) which occur in soils containing adsorbed Ca or Mg, and which are quite or almost undecomposed by water, become decomposable into primary particles on substitution of Ca or Mg by other cations. The action of the hydrogenion is very weak in this respect. However, soils saturated with repect to the hydrogen-ion contain quantities of colloidal particles which influence profoudly the physical properties of the soils. On the other hand, the action of Na in this respect is extraordinarily strong. Thus while an analysis of a loamy soil sample in its natural condition, i. e. the

adsorbed bases being Ca and Mg, gave 39.9 % of the particles as being $<$ 0.001 mm. and from among those only 1.3 % particles of 0.22 micron, the substitution of the adsorbed Ca and Mg by Na gave 59.8 % of particles as being $<$ 0.001 mm., while from among the latter as much as 45.3% were of 0.22 micron. The cause of this phenomenon is that, while the ions in a solution of a soil saturated by Ca are Ca and OH, in a solution of a soil saturated by Na the ions are Na and OH. In the latter case the stabilising action of the hydroxyl-ion on the organic and aluminium silicate soil particles is much greater than the coagulating action of Ca. Solutions of soils saturated by the hydrogen-ion and which contain in the soil solution hydrogen-ion, but, of low concentration, and whose coagulating action with Ca is also low, occupy an intermediate position and are much nearer to the soils saturated by Ca and Mg

The same causes also bring about the different structure and unequal stability of the different soils saturated by Ca and Mg (e. g. black-earth soils), Na (Solonetz soils) and H (Podsol soils). AUTHOR.

Soils Deficient in Bases. Methods of Determination of Hydrogen-ions present in an Adsorbed Condition. The Requirement by Soils of Lime to neutralise Unsaturation.

GEDROIZ, K Von Basen nicht gesattigte Böden. *Journal f. Experim. Agronomie*, 1924.

Experiments on washing soils with cold hydrochloric acid of different concentrations until the washings no longer give the characteristic Ca test proved that hydrochloric acid af 0.05N. and lower concentration, has almost no action or very little on the organic part of the soil, or on the aluminium silicate part. It does not decompose them and the only reaction is to exchange its hydrogen for the bases adsorbed by the soil, which then pass into solution. The hydrochloric acid has in this case the same action as a solution of a neutral salt, e.g. of ammonium chloride. The hydrogen ion has the same capacity as other metallic cations of penetration into the adsorbed soil complex (into the zeolitic and humous part of the soil) and of displacing the adssorbed bases present. Correspondingly all cations are equivalent in this respect and their penetration into a soil displaces from the latter equivalent amounts of adsarbed soil bases.

These investigations enable a deeper insight to be obtained into the nature and origin of soils which are deficient in bases, and to devise a more scientific method of determination of the degree of unsaturation of such soils with regard to bases. A soil unsaturated by bases is a soil whose adsorption complex contains a hydrogen-ion, the latter having the property of being able to be displaced by any other metallic cation. For the determination of the amount of hydrogen-ion present in the soil, i. e. its degree of unsaturation by bases the same methods of displacement may be used, which are in use in the determinations of the other adsorbed cations which may be found in soils. The most suitable salt for the displacement of the hydrogen-ion is $BaCl_2$ (1-0.5N.). The soil is treated

on a filter-paper with such a solution until the displacement of the hydrogen-ion is complete — as shown by methyl orange. The amounts of free hydrochloric acid in the washings is determined by titration. This method of determination of the degree of unsaturation of a soil with regard to bases, serves at the same time as a determination of the lime requirements of the soil, as a neutraliser.

The investigations of soils, when all adsorbed bases have been displaced, by treating them with 0.05 N.HCl show that: (1) the adsorbed hydrogen-ion can again be displaced by any desired cation;

(2) the decomposing and dissolving action of water on the organic and aluminium silicate adsorption complexes of the soil is considerably greater in the case of soil saturated by hydrogen-ions than in those saturated by bases,

(3) the process of podsol formation in soils is, from a chemical point of view, characterised by two stages: (*a*) the atmospheric water trickling through the soil displaces in the end all the bases present in the adsorbed soil complex by its hydrogen-ions; the presence in the water of free acids increases that displacing action of water, while, on the other hand, the presence in the soil of easily soluble salts or carbonates of Ca and Mg (in greater or smaller quantities) prevents this exchange of hydrogen-ions for the bases present in the soil; these salts protect the soil against podsol formation by the action of atmospheric water, and only when these salts are removed can the podsol formation begin.

(*b*) Simultaneously with the formation — in the above described manner — of organic and mineralogical adsorption complexes deficient in bases — proceeds an energetic washing-out action of these complexes from the soil; the soil becomes deficient in zeolitic and humous components.

The lime which serves as a means of decomposing and neutralising the unsaturated basic compounds, at the same time protects the soil against the destruction and removal of its most valuable part the adsorption complexes. AUTHOR.

The Disintegration of Beton by the Chemical Action of Soil Water.

GESSNER, H Betonzerstorung durch chemische Einwirkung des Grundwassers. Agrochemical laboratory of the E T.H. *Schweizerische Zeitschrift fur Strasservesen*, Nos. 5 and 6, Zurich 1925.

The author hopes that this short abstract of his work will be forgiven him in view of the enormous practical importance of the problem and with which the soil-scientist has occasionally to deal, and in view of its importance in the use of cement drain pipes in soil improvements.

The author, as a chemist to the Swiss Commission for the Investigation of Cement Pipes in Improved Soils, has studied a large number of cases of disintegration and has carried out analyses. The analyses included soil sections, soil solution as well as drainage water, and beton in very different stages of disintegration. The abstracted work is written

mainly for the building expert and contains therefore as few chemical references as possible.

As a result of two years study the following conclusions are drawn; Injurious to cement are:

(1) Strong acids- these do not occur in nature, but are found in the industrial refuse-waters;

(2) Weak acids, carbonic acid, "humic" acid, i. e. organic complexes found in the soil and reacting as acids — found often in soils free of lime and in soil waters;

(3) Acid action of apparently neutral soils, liberated by neutral salts. Found very often in peat soils and much more seldom in mineral soils (soils whose water extract has a neutral reaction, which, however, show a degree of acidity by the BAUMANN-GULLY method).

(4) Sulphates found in flat moor land as gypsum, more rarely in mineral soils, gypsum waters and chimney gases;

(5) Magnesium salts- found in mineral soils, very often in soils rich in lime, more rarely in peat.

The chemical action of acids is quite clear in view of the alkaline character of Portland cement. Large amounts of carbonic acid may lead to complete destruction, and the same result can be brought about by the acid reaction of apparently neutral soils, which is due to the cation exchange — H-ion against the alkali-ion or alkaline earth-ion and which is caused by the neutral salt.

Sulphate disintegrations have been known for a long time under the name of "gypsum drive", due to the crystallisation in the cement of the calcium-sulpho-aluminate which has a very high water of crystallisation.

The action of the magnesium salts, which are present in soils rich in lime mainly in the form of the carbonate, is probably due to the exchange of the Mg-ion for the Ca-ion of the cement gel, and on account of their higher hydration have a softening action on the beton. In general, the most dangerous and the most injurious conditions for any beton object are those brought about through the change in the soil water level, which causes the object that at one time was surrounded by water, at another time to be under dry conditions.

A number of examples from the literature and from the author's own practice are quoted and treated in greater detail and explained by means of two photographs.

As precautionary measures are suggested the production of a particularly dense beton (by pressing, stamping, fat mixing), together with a careful working and long storing of cement objects. There is not enough experience available about special forms of cements or of special coating as preventives. AUTHOR.

The Disperse Systems of the Soil.

GLINKA, K. Die dispersen Systeme im Boden. Leningrad, pp. 1-75.

The author gives a short account of the Russian and western work dealing with disperse systems and their relation to soil Science. The

object of the work is to give an explanation of the origin of the different soil types. This brief work contains the following chapters:

1. The conception of disperse systems.
2. Soil suspensions.
3. Soil colloids
4. Adsorption phenomena in suspensions and colloids.
5. Electric adsorption and coagulation.
6. Mutual coagulating action of colloids.
7. Protective action of the humus-soils.
8. Chemical adsorption in soils.
9. Adsorption of gases and liquids (water).
10. Soil solutions.
11. Origin of different soil types in the light of dispersoid chemistry:
    (*a*) Origin of the laterite type
    (*b*) » » » podsol »
    (*c*) » » » steppe »
    (*d*) » » » solonetz »
    (*e*) » » » moor and solontschak type.

AUTHOR.

Investigations on the Acidity of Soils in the Neighbourhood of Leningrad.

GLINKA, K Kurzer Bericht über die Untersuchung der Azidität der Böden. *Annals of the State Institute of Experimental Agronomy,* Part III, No. 1, 1925, Leningrad.

The author has investigated the active acidity and exchangeable acidity of the podsol, gley-podsol, moor and Bendzina soils. The active acidity was determined by means of indicator methods as well as by electrometric methods (with quinhydron electrode). For the active acidity the following conclusions can be drawn:

(1) The upper soil surface (A) has the maximum acidity.

(2) The low-land moor soils generally have a P_H value of 5.5-6.0.

(3) The podsol and gley-podsol soils give a maximum value for acidity when the soil sample is taken from forests. The P_H value is then 4.5 (very seldom 4.8). Arable soils of similar morphology show lower acidity (P_H 5 5-5.8-6.0-6.2).

(4) The gley soils are the least acid, and their deeper layers may even show a neutral or weakly alkaline reaction.

(5) The bendzina soils are almost neutral in their upper laxers, while their lower levels may even show an alkaline reaction (P_H 7.7-7.8-8.0).

For the exchange-acidity using the method of Prof. GEDROIZ the following results were obtained:

(1) The upper soil surface (A) has the maximum acidity.

(2) The non-moor soils have a very slight acidity, which may be for the upper layers 0.0004 % H.

(3) The maximum exchange-acidity for the soils taken from forests was 0.002-0.0035 % H for the upper layers. AUTHOR.

A Simplified Method for the Determination of Lime in S oils.

GROSSFELD, J. Vereinfachte Verfahren zur Kalkbestimmung in Ackerböden. *Zeit. f. Pflanzenernahrung und Düngung*, Vol No. 1-2, pp. 93-103. Leipzig, 1925.

The author describes for the determination of limes in soils an indirect and a direct method which both give good results.

The first consists in evaporating to dryness in a platinum capsule the soil solution obtained by mixing 150 gm. of air-dried soil with 300 cc. of hydrochloric acid (S. g. 1,15), then heating the mixture for an hour to boiling point. After allowing to cool, it is heated to redness and 20 cc. of a 2 % solution of ammonium oxalate are added and a certain amount of soda, and then oxalate of lime ; it is evaporated to 100 cc., filtered through a fine filter paper and the excess of oxalate determined by means of a solution of permanganate.

With the direct method, the soil solution is made almost neutral and 4 % ammonium oxalate added and, afterwards, 25 % sodium and ammonium acetate. The solution is filtered through fine filter paper, and is first washed with cold and then with hot water ; the precipitate is dissolved in hot 10 % nitric acid and then washed with water and titrated with permanganate solution. With this method the most exact results are obtained with clay soils. A. F.

The Physical Properties of Forest Soils and their Relation to Soil Acidity.

NEMEC, A. and KOAPIL, K. Einige physikalische Eigenschaften der Waldböden. (From the Biochemical Institute of the State Experimental Station for Forestry Investigations, Prague). *Zeitschrift für Forst- und Jagdwesen*, Year 57, pp. 540-567, tables 6.

Continuing their investigations on the influence of pure coniferous and pure deciduous trees and of mixed coniferous and deciduous stands on mineral soils, the authors have investigated certain Bohemian forest soils, of very different geological origin, but they have restricted their investigations to the active acidity and to some of the physical properties of the soils. They thus investigated alluvial sandy-clay and clay soils, chalk formation sand soils, primary formation sandy loam-soils and (Sozän) sandstone clay soils. Space does not admit reproduction of the tables appended to the original paper, but the general conclusions given by the authors are as follows :

The unfavourable physical properties of soils of dense *purely coniferous* tree stands result in an accumulation of strongly acid humus (upper surface humus) which cause a diminishing air capacity and these two causes together, strong acidity and lower air capacity, are the main reasons for the failure of the natural rejuvenation. Timely removal of

the upper layer, by bringing about an accelerated litter decomposition will counteract these unfavourable conditions. More openly grown stands show therefore always a lower acidity and a higher air capacity. The absolute water capacity is in general inversely proportional to the absolute air capacity.

Also, close *purely deeciduous* tree stands show a relatively small air capacity, although the soil ventilation is usually in this case much more favourable than in the case of purely coniferous tree stands. The relation, acidity-air capacity, is in the case of purely deciduous tree stands not so close as in the case of purely coniferous stands, although there is a resemblance.

In soils of *mixed tree stands* the air capacity undergoes considerable variation. A direct relation between it and acidity could not be traced, even approximately. In humus-covered, vegetation-free forests, with mixed tree stands, a much higher air capacity was found than in the case of dense coniferous or deciduous stands when grown on soils of corresponding formations.

The absolute air capacity is, in the case of mixed tree stands, in general much smaller than in the case of loose, well lighted deciduous formations.

The authors then study the relation between their results and the most important CAJANDERS forest vegetation types. The *oxalis* type has a moderately acid soil reaction and a fairly high air capacity, the *Myrtillus* type has its optimum at a somewhat higher degree of acidity and lower air capacity, and the *Calluna* type has its optimum at the highest degree of acidity and lowest air capacity.

GROHSKOPF.

Modern Methods of Soil Investigation with Respect to the Biochemical Methods of Nutritive Content Estimation of Soils and the Effect of Inoculation.

NIKLAS, H. Die moderne Bodenuntersuchung insbesondere zur Ermittlung des Nahrstoffgehaltes der Boden und des Verhaltens der Boden bei der Impfung. *Tonindustriezeitung*, No. 14, 1925.

After a short consideration of the results obtained in the soil reaction investigations at the Agrochemical Institute of the High-School of Weihenstephan, the author gives an account of the stage reached by him and his collaborators in the biochemical investigations, begun at the suggestion of CHRISTIANSEN and STOKLASA, on the nutritive-content estimation of soils and their behaviour towards inoculation. The question of the inoculation of soils, especially with nitrogen fixing bacteria, seems to depend primarily upon the conditions, and only investigations concerning this point, together with the employment of biochemical methods, will enable us to say with certainty what are the conditions for making bacteria-free soils capable of inoculation.

AUTHOR.

Determination of the Reaction and the Lime Requirements of the Pfalz Soils.

NIKLAS, H. and HOCK, A. Bestimmung der Reaktion und der Kalkbedürftigheit von Böden der Pfalz. *Praktische Blätter der Bayerischen Landesanstalt für Pflanzenbau und Pflanzenschutz*, 1923, No. 8-9-10.

A number of soil samples taken from very different geological formations of the Bavarian Rhine-Pfalz have been investigated by various methods, and the results obtained are shown in tabular form. It was proved that the geological conditions are of primary importance in determining the reaction and the lime requirements of a soil, but within the same formation local influences and the particular cultivation of the soil may also be of greater or less importance. NIKLAS.

Colorimetric Reaction Investigations of Soils in Agricultural Practice.

NIKLAS' and HOCK, A Die Reaktionsuntersuchungen der Böden mit kolorimetrischen methoden in der landwirtschaftlichen Praxis. *Tonindustriezeitung* 1925, No 33.

The authors report on the results obtained in tests carried out with an apparatus made by the firm of E. MERCK, Darmstadt, for field investigations of soil reactions. From consideration of the results obtained they conclude that the field method is unsuitable and that soil reaction, investigations must be carried out in scientific institutions. NIKLAS.

The Nature of Soil Acidity in Forests Soils.

NIKLAS, H and HOCK, A. Zur Frage der Bestimmung der Formen der Bodensäure in Waldböden. *Forstwissenschaftliches Zentralblatt*, 47, 1925.

The authors point out that, just as in the case of arable soils so in the case of forest soils we should not only determine the actual acidity, but the titrational and exchange acidities as well. Using electrometric titration methods and making the ordinates to represent the values of P_H thus obtained and the abscissae to represent the quantities of alkali used, a series of characteristic reaction curves results in the case of forest soils, from which the manner of their acidification can be derived. Strongly dissociated acids, e. g. the exchange acids conditioned by aluminium salts, gave a slowly rising curve, which on completed neutralisation by addition of a very small quantity of alkali, rose very steeply from the neutral point, through several P_H values, to a quite considerable P_H value. From other experiments the author showed that soils with exchange acids contain mainly acid aluminium salts, which give curves very similar to the above, and hence from the curves resulting on soil titration it can be easily shown whether the soil contains exchange acid or humous acids The latter acids are also shown, in a table appended to this paper, to give very characteristic curves. The paper does not say how ar it is possible by using electrometric titration to determine the buffer

properties of a soil and also to find whether a neutral soil contains sufficient buffer substances to permit the development of bacterial life.

NIKLAS.

The Importance of Carbonic Acid as a Fertiliser.

NIKLAS, H., SCHARRER, K. and STROBEL, A. Die Bedeutung der Kohlensäure als Dungemittel. *Zeitschrift fur angewandte Chemie,* 38, 251, 1925.

The previous work on this question is exhaustively reviewed and discussed. The experiments described were carried out with carbonic acid fertilisers produced by the chemical works Bayern at Reichertshofen near Ingolstadt This fertiliser consisted of 50 % peat, 45 % wood charcoal and 5 % lignite. It had a very favourable influence on many plants, especially potatoes As to the question of fertilisation with carbonic acid, it is necessary to continue the investigations for a number of years to settle finally the effectiveness or otherwise of carbonic acid fertilisers.

K. SCHARRER.

Investigations on the Reactions and Lime Requirements of Soils, Carried out by the Institute of Agricultural Chemistry of the High-School of Weihenstephan during 1923-24.

NIKLAS, H and VOGEL, F Bodenuntersuchungen auf Reaktion und Kalkbedarf durch das agrikulturchemische Institut der Hochschule Weihenstephan. *Landwirtschaftliches Jahrbuch fur Bayern* 1925, Nos 5-6.

After a short description of the methods applied an account is given of the results obtained from 2255 soil investigations carried out by the Institute. Of those investigated, 50 % have been found to be weakly to strongly acidic, 15 % neutral and 35 % alkaline. Of 1285 soils samples sent in by official Bavarian stations, and investigated by various methods by A. HOCK, 34 % were found to be absolutely lime deficient, 23 % required only a limited lime supply and 43 % required no lime. It could also be shown that the geological conditions of the soil were of primary importance in determining the character and the lime requirements of a soil. It was further proved that quantitative methods by themselves give a very superficial, and in most cases very erroneous idea of the true condition, and a warning is given as to their use in actual practice. In an appendix, tables are given of the reactions shown by the different soils sent in from official and private sources, and they also show the total acidity of the soils. Also, the soils belonging to the different geological formations are arranged according to the same scheme. In addition, a description is given of the methods used in taking samples, an example of the questionnaire used is given, and an explanatory note is given relative to the informations published by the Institute.

NIKLAS.

An Account of Experiments from the Unpublished Work of the late Alfred Koch. A Contribution to the Knowledge of the Nitrogen Activity of Arable Soils.

RIPPEL, A. Versuche aus dem Nachlass von ALFRED KOCH. *Journal für Landwirtschaft*, 72, No. 1, 17, 1924.

The experiments described briefly in this paper include experiments on fallow land as well as continuous cultivation experiments with winter crops and pastures, experiments with buried cylinders on fallow soil, on spontaneous growth experiments, pot experiments on the nitrogen activity of soils from different depths, and finally experiments to determine the influence of various organic substances on the nitrogen capacity of different soils. The author does not share the late A. ROCY's view as to the considerable evolution of nitrogen during a crop root fallow, and he believes himself to be supported in his opposite views by the experience gained from the twenty years' fallow land experiments carried out on the land of the Institute of Agricultural Bacteriology of the University of Göttingen. He admits that A. KOCH probably had in mind the possibility, but not the fact, of a nitrogen fixtion during a fallow. He does not go deeper into details or into less important questions, neither does he review the literature on the subject. NIKLAS.

The Preparation of Magnesium-Ammonium Phosphate in the Estimation of Phosphoric Acid or Magnesium.

SCHMITZ, B. Ein Beitrag zur Herstellung des Magnesia-Ammoniumphosphatnie derschlages fur die Bestimmung der Phosphorsäure bezw des Magnesiums. *Zeitschrift für analytische Chemie*, vol. 65, Nos. 1 and 2, pp. 46-53, 1924.

The author bases his investigations on the previous work of H. NEUBAUER, an abstract of which was published in the Journal in 1894.
NIKLAS.

The Organic Substances of the Soil.

SCHMUCK, A. *Transactions of the Kuban Agricultural Institute*, Part I, No. 2, 1923, pp. 1-92, Krassnodar.

In the first part of his work the author gives a review of the literature on the nature of soil organic substances and particularly on humic acid. The following conclusions were drawn:

(1) The organic compounds in the soil form a complex mixture consisting of very different organic substances. The greater part of the organic substances isolated from the soil by American workers are not invariably present, but are in close relation to the former cultivation of the soil.

(2) The greater part is of a different nature and forms a characteristic organic compound, whose content varies in different soils.

(3) A considerable part can be separated by solution in alkalies and precipitation by acids as humic acid.

(4) Chemically, it represents a nitrogen containing substance of an acid type.

(5) The acid character is due ,partly to adsorption by the colloidal humic acid and partly to the presence of carboxyl groups.

(6) The salts of humic acid are not true salts formed in stoichiometric proportions, but, complicated chemical and adsorption compounds.

(7) The solubility of humic acid in water is slight, and the transition from the soil-state depends upon the presence of suitable protective colloids. Under suitable conditions, the formation of a stable colloidal solution is fairly easy, that solution then showing all the properties of organic emulsions.

(8) The nitrogen containing part of the humic acid resembles albuminous substances and gives similar hydrolytic decomposition products.

(9) The albumin of the organic substances of the soil are not exclusively plasm-albumin, since they ar not accompanied in the soil by glycosamine.

(10) Humic acid contains benzene ring compounds.

(11) The unsaturated character of the compound is shown by its easy combination with halogens and its easy oxidation with alkaline $KMnO_4$

(12) The hydroxyl groups enter, most probably, the side chains in the benzene ring of the humic acid.

(13) The ash of humic acid is mainly the ash of the albumin.

In the second part the author describes experimental work on humic acid. He isolated from the soil 300 gm. of a substance usually regarded as humic acid. The substance had a somewhat complex composition and gave besides slight amounts of substances soluble in ether benzene, ligroin and chloroform, about 14 % colophonic acid and calophonic ester and about 80 % of a specific substance to which the name humusic acid was given.

This substance had a decidedly acid character and contained both hydroxyl and carboxyl groups. It is colloidal and may occur in two forms, soluble and insoluble in water. When freshly precipitated from alkaline solution it is fairly soluble in water, but does not diffuse through membranes.

Analysis gave the following percentage results, calculated as ash-free substance, C-61.8, H-4.2, N-3.2. The ash is not organically combined with the substance and is only a difficultly separable admixture. There is no doubt that the nitrogen contained in it is in the form of ordinary albumin compounds. On prolonged hydrolysis a part of the substance goes into solutiou, and the insoluble residue contains only small amounts of nitrogen. The author believes that a chemical analogy indeed exists between the albumin, the artificial humic bodies and the humusic acid of the soil.

These compounds are remarkable for their low H and N content and their high C and O content. A further analogy consists in the fact that

all of them correspond approximately to the composition $(C_5\ H_4O_2)_n$ With such a structure they must contain a large number of double forms and should give condensation products. The author considers that from very different complex organic compiuuds, by the splitting off of coater, and condensation, similarly constituted substances can be obtained, and hence, that humic acid can be obtained from many widely differing substances. AUTHOR.

Methods of Estimation of Phosphoric Acid in Soils.

SCHTSCHEPONOWSKY, A. Zur Methodik der Bestimmung des Phosphorsäuregehaltes im Boden. *Engelhardt's Versuchsstation*, No. 2.

The SONNENSCHEIN method for phosphoric acid estimation in soils so largely used by agricultural chemists, is unsuitable for two reasons. Firstly, its use in volumetric analysis is very inconvenient, and secondly it does not yield sufficiently accurate results, because the treatment of the soil with the common acids — H_2SO_4 and HNO_3 — introduces impurities.

The purpose of this work was to find a method which would yield, in volumetric analysis, better results than SONNENSCHEIN'S method and after a large number of experiments this was found in NIESSEN'S method. The phosphate in the soil is precipitated once with a molybdate solution and after dissolving in standard caustic potash solution, the solution thus obtained is titrated with H_2SO_4 But, since the solution must be pure, an attempt was made to oxidise and dissolve the phosphate by first treating every 10 gm. of soil with 50 cc., or more, of 0.1N. permanganate solution, acidified with sulphuric acid, and then boiling for half an hour. The residue left in the permanganate is then decomposed with oxalic acid and the solution diluted with water to 250 cc. For the phosphate estimation by NIESSEN'S method 50 cc. of solution are taken. AUTHOR.

On the Adsorption of P_2O_5 by Soils.

SOKOLOW, A. Ueber die Adsorption des P_2O_5 durch den Boden. *Engelhardt'sche Versuchstation*, No 2

The author estimated the adsorption of P_2O_5 in relation to the amount of combined lime. For that purpose he increased the lime content an : then displaced it byNH_4. 100 gm. absolutely dry soil contained in mgm.:

	Combined lime	Adsorbed P_2O_5
Original soil	411	341
Soil treated with $CaCl_2$	588	609
» » » NH_4Cl	—	11

AUTHOR.

The Origin of Alkaline Soils (from the Russian).

VILENSKY, *La Pédologie*, 36-58 pp., 1924.

Alkali soils differ from acid soils by the fact that their upper surfaces show an almost complete absence of easily soluble salts, while deeper down is a solid surface nearly impermeable to water. Below this surface are found NaCl, Na_2SO_4 and Na_2CO_3. From his investigations and studies, the author arrives at the following conclusions: The salt soils were formed in those places where the ground water through capillary attraction reached the upper soil surface and evaporated. Alkali soils were formed from the salt soils when rain-water again reached the lower layers and washed out the salts. They then affected the undersoil. This theory agrees with the views of geologists on the question of climate after the ice-age. According to those views the then higher temperatures brought about the formation of deserts and hence also of salt soils further North, which soils were later by the above process converted into alkaline soils. HELLMERS.

Salt Soils, their Origin, Composition and Methods of Improvement (from the Russian).

VILENSKY. (New Village), Moscow, 153 pages, 1924

This work deals with the Russian salt soils of the region of the lower Volga and distinguishes between wastes and half wastes, the dry steppes and black-earth, the forest steppes and forest zones. The author has carried out analyses of all these different types and of samples taken from different depths, and made also both total analyses as well as analyses of water and hydrochloric acid extracts. In the next chapter, in greater detail, the flora of the salt soils is dealt with and an interesting table is given showingwhat salt concentrations of NaCl, Na_2SO_4, Na_2CO_3, $NaHCO_3$ and $MgIO_4$ the different cultivated plants can tolerate. Then follows a chapter on the origin of the salt soils and their place in the general soil classification, and it is shown that there exists no sharp line of demarcation between salt soils and alkaline soils. In conclusion the author points out the importance of salt soil investigations on the general question of the history of the earth in the post-glacial period. HELLMERS.

The Importance of Gypsum in Agriculture (from Latvian).

VITINS, J. (WITYN, J.). Riga, pp. 44, 1925.

The author draws attention to the very numerous gypsum deposits found in Latvia. They are found in the Devonian loam deposits, and in some places reach a thickness of 3-4 metres. In some places the deposits are found almost on the surface. The water of many springs contains dissolved gypsum. Thus for example, the main springs at Kemmern yield annually about 700 cc. of dissolved gypsum, and the whole

neighbourhood of Kemmern yields about 2000 cubic metres. Even the sea at Kemmern is richer in gypsum than anywhere else in the Baltic.

The author discusses the questions of fertility and of exhaustion of the soil, the question of the profitable and unprofitable years on different soils in the temperate climatic zone, and arrives at the conclusion that in the temperate zone the coagulation of the fine soil products under the influence of electrolysis is of paramount importance.

The soils in the temperate zone contain usually only inappreciable amounts of divalent cations. Rich crops are obtained especially after severe winters, when the soil gets frozen through, or in in dry summers. The coagulating capacity of the divalent cations must be increased by the frost and by the dryness. The unprofitable years are a common experience on acid podsol soils and are due to a lack of divalent cations (particularly of Ca). But unprofitable years occur also on neutral soils, when the soil has not been manured for several years in succession, when the amount of precipitation was considerable and when no freezing through or drying out of the soil has taken place. To illustrate his statements the author gives several examples which show an increase in the degree of dispersion produced by precipitation. From this point of view gypsum is an important and a cheap means for keeping the fine soil particles in a state of coagulation. According to the author, 1 part of gypsum to 10 000 parts of water suffices to bring about a settling of the fine particles of a soil in 24 hours, while a 3-4 times stronger concentration is necessary to cause the settling of the fine particles of a more acid soil.

The author next considers sulphur as a plant food and the quantities of sulphur which are supplied to the soil by the atmosphere and through dung manuring. Hence he concludes that sulphur may be present in podsol soils in minimum quantities even without their being manured with superphosphate, especially if it is cultivated with hoed crops or Papilionaceae. Also in these cases gypsum may be of importance. Finally, he points out the importance of gypsum as a means of removing the alkaline reaction of a soil caused by the presence in it of sodium and potassium carbonate. This was known for a long time in the case of solonetz soils, but it is of special importance in gley and podsol soils, where excessive liming gives negative results. The author mentions the types of soil on which the experiments with gypsum should be tried, and assumes that the doses of phosphoric acid fertilisers could have been diminished if gypsum had been used.

In the opinion of the author, gypsum should be of great importance in the case of loamy soils when potatoes, rye and certain types of hoed crops, which require loose soils, are cultivated on them. Certain experiments with clover have shown that when using gypsum in the case of heavy very acid soils, the amount of phosphoric acid present may be a minimum. The use of gypsum in the case of clover on light, acid soils, which are available for the deeply rooted plants have yielded very good results.

L. Frey.

I. The Principal Phases of the Podsol-Forming Process. — II. The Fertility of the Soil in its Relations to Soil Acidity.

(A summary of some soil investigations in Latvia).

WITYN, J. An address given at the IV International Soil Science Congress, Rome, 1924, pp. 32, illustrated, Riga, 1924.

I. The author considers briefly the phases of podsol formation in Latvia, and the subsoils, and different heights of the ground water level. With regard to the ground water the author distinguishes three cases (1) where the water level lies very deep, (2) where water level lies near the upper surface; (3) where the water passes to the upper surface. In the first case the author considers in greater detail the soil development on the following subsoils (1) loams with 20 % $CaCO_3$, silt content 20-30 %, (2) sandy loams with about 10-15 % $CaCO_3$ and about 10-20 % silt, (3) moraine detritus with high $CaCO_3$ content; (4) Sand. In the second case he deals in detail with soils whose subsoil is (1) marl-clay, (2) sand. For the third case the formation of the different deposits is closely dependent on, and is characterised by the composition of the ground water. All the cases mentioned are illustrated by soil sections.

II. The second part is a brief summary of the principal conclusions arrived at by the author in his second work (see J. VITINS (J. WITYN) "*The richess and the Fertility of Soils*". Riga, 1924). L. FREY.

Soils and Vegetation.

The Influence of Titanium on Plant Production.

BLANCK, E. and ALTEN, F. Ein Beitrag zur Frage nach der Einwirkung des Titans auf die Pflanzenproduktion. *Journal für Landwirtschaft*, 72, No 2, p. 103, 1924.

The authors tested the results obtained by ANTONIN NEMEC and VACLAV KÁŠ, who obtained by the use of Titanium a considerable increase in the yields of mustard, peas and lucerne, and who therefore ascribed to it specific functions in the process of assimilation. Increasing admixtures of Titanium to the fertilisers gave increasing yields and a maximum yield was obtained on addition of 0.5 gm. of sodium titanate. BLANCK and ALTEN were unable, with the same experimental arrangement, to confirm the above results, and even the application of colorimetric methods did not show that any ascertainable amounts of Titanium had been taken up by the plants. No secondary effects could also be shown, hence they conclude that Titanium, at least in the form of sodium titanate, has no influence on the production of plants.

NIKLAS.

A Plant Test with "Asahi-Promoloid".

BLANCK, E. and ALTEN, F. Ein Vegetationsversuch mit « Asahi-Promoloid ». *Journal für Landwirtschaft*, 72, No 3, p. 139, 1924.

The authors have made pot tests with this preparation which is an artificially prepared product and consists probably of a magnesium com-

pound containing also silicic acid, the action of which seems to be catalytic. To the soil fertiliser were added three known and increasing amounts of "Promoloid", which resulted in increasing yields of grain, but no increased yield of straw; the total crop was not increased. The authors intend to test these results in actual practice. NIKLAS.

Experiments on the Disintegrating Effect of Liquid Manure on the Mineral Components of the Soil.

BLANCK, E. and ALTEN, F. Versuche mit Jauchedrill bei Häfer über den autschliessenden Einfluss des Jauche auf die Mineralbestandteile des Bodens. *Journal für Landwirtschaft*, 18, No 3, p 129, 1924.

The application of the PLATH liquid manure treatment in the case of rape had a much better effect than the ordinary application of liquid manure. Repeated experiments in the case of oats prove that the liquid manure treatment will not bring about an action similar to that of either nitrate of soda or of ammonium sulphate. However, other experiments with fresh pig urine on loamy soils indicate that a solvent action on the mineral components of the soil may be attributed to liquid manure. NIKLAS.

The Effect of Zeotokol (Ground Dolerite) on Plant Production.

BLANCK, E and ALTEN, F. Zur Wirkung des Zeotokols. *Journal für Landwirtschaft*, 72, No. 3, p. 146, 1924.

In 24 zinc vessels, tests were made with Zeotokol on three different soils, maize being selected as the experimental plant. The effect of Zeotokol on the dry substance was somewhat unfavourable, while its influence on account of its supposed colloidal properties was noticeable. Hence the authors conclude that this preparation is of no value.

NIKLAS.

The Effect of Depth of Covering on the Sprouting and Early Development of Pine (*Pinus sylvestris*) Seed.

DENGLER, A. (Researches from the Moller Institute of the Forestry High-School, Eberswalde). *Zeitschrift für Forst- und Jagdwesen*, Year 57, pp. 385-468, 4 tables and 10 illustrations.

The following is a summary of the chief results:

The sprouting numbers decrease with increasing depth of covering in the case of all soils; 0.5-1 cm. of covering depth found to be the most favourable. The time necessary for sprouting increases with increasing covering depth and with the soil hardness. The percentage decrease of germintion is especially marked in depths above 2 cms. The depth of covering determines the type of sprouting. Four types of sprouting can be distinguished:

(1) Hook type; (2) claw type; (3) etiolated, stunted forms; (4) killed. GROSSKOPF.

Investigations on the Acidity of Brandenburgian Beech and Scots Pine (*Pinus Sylvestris*) Habitats, taking Typical Habitat Growths as a Standard.

HARTMANN, F. K Untersuchungen zur Azidität märkischer Kiefern- und Buchenstandorte unter Berucksichtigung typsischer Standortsgewachse als Weiser, *Zeitschrift fur Forst- und Jagdwesen*, Year 57, pp 321-350.

The author has rendered service in showing the relation of soil acidity to the different floral habitat (arranged mainly according to CAJANDER).

From the large, partly graphic tables it is evident that the habitat growths, beginning with the most acid heather (P_H -4 and under) to sweet grass (P_H -7 and over) which prefers a neutral reaction, extend within fairly wide acidity limits, but that their optima are found within narrower and narrower limits. The same is true of the beech, although its optimum lies within much wider acidity limits, more towards the neutral side. On the other hand the Scots pine occupies a region which extends from alkaline to a very marked acidic reaction and its optima are found to occupy similar, fairly wide regions. The titrational acidity was determined by the DAIKAHARA method, the P_H values were determined by the method of GILLESPIE using different indicators, and by the method of WHERRY using a general indicator. In the P_H determinations special attention was paid to the root depths.

GROSSKOPF.

The Development of Roots of Different Potato Varieties as shown at the Göttingen Experimental Station.

KLÄSENER, O Wurzelentwicklung verschiedener Kartoffelsarten nach den Verhaltnissen des Gottinger Versuchsfeldes *Journal für Landwirtschaft*, 72, Nos 1-2, 1924

The author discusses the scanty literature on the subject, and, since the development of roots is conditioned to a large extent on the physical and chemical properties of the soil, he then describes the properties of the soil of the Gottingen Experimental Station. A description is given of the method of investigation as applied to four different potato varieties. The number of both primary and secondary roots was ascertained, their length, depth of penetration, lateral expansion and water content. It is of interest to note that both the field-plants and the pot-plants had the same number of roots. The author could not confirm the conclusions arrived at by SEELHORST and KRAUS that the worm holes do not influence the depth of penetration of the roots of a plant, but is inclined to support the opposite view of JENSEN. From his work he concluded that the potato, like all other plants, in the development of its roots, attempts to develop a definite plan as it does in the development of its aerial part. He shows also that the roots of the

four potato varieties investigated, even without lupins, penetrate to a depth of 120 cm. The lateral roots seek especially the upper soil layers, which are the most favourable for their development. The upper roots have a specific function still unknown to us.

NIKLAS.

The Fertilisation of Pasture by Liquid Manure, with Relation to the Utilisation of the Nitrogen of Liquid Manure for Green Fodder Production.

LIECHTI, P and RITTER, E. Ueber die Wesendungung mit Gülle *Landwirtschaftliches Jahrbuch der Schweiz*, Vol 35, p 1, 1921.

The authors have studied a problem of paramount importance for the Swiss agricultural industry. The first point to settle was to find the most suitable yearly application of liquid manure for a soil. A light, to medium heavy, lime-deficient, sandy soil, was divided into a number, of meadow plots each of an area of 50 sq. metres and each manured. The exhaustive results are arranged in 13 tables, each table of several pages, and the following are the main conclusions :

(1) In a liquid manure fertilisation of grassland only larger amounts of manure give a good yield of nitrogen, smaller amounts, even if repeated several times, give comparatively high losses of the nitrogen by evaporation.

(2) When using large amounts of liquid manure large amounts of lime also reach the soil, but these can only be utilised if at the same time large quantities of phosphatic manure are supplied.

(3) Large amounts of liquid manure produce a lime-deficient fodder, and this unfavourable action of the manure can be counteracted by a heavy application of lime.

(4) Liming of the soil brings about both an improvement in the quality of the fodder and an increase in the crop.

(5) Potassium phosphate manuring alone, resulted always in diminished crop, but potassium phosphate and liquid manure gave an increased yield.

(6) Each addition of fertiliser brings about a simplification in the botanical constituents, the clover varieties are repressed, but the albumin content of the fodder does not suffer.

(7 Fertiliser conditions or weathering conditions influence the water content of the grass but little ; the grass has the lowest water content on unfertilised plots.

(8) Non-nitrogenous fertilisers give a grass of better quality, but nitrogen containing fertilisers give a much heavier crop. The profits from nitrogenous manuring are considerable.

(9) If it is not possible to apply a nitrogenous fertiliser, a high nitrogen crop can be obtained by a simple potassium phosphate manuring. In these experiments the crop per hectare per year was 40-200 kg. on non-limed plots and 70-230 kg. on limed plots.

GESSNER.

The Influence of Climate and Soil on Plant Life.

LUNDEGARDH, A. Klima und Boden in ihrer Wirkung auf das Pflanzenleben. 113 figures and 2 charts, pp 319. Publisher Gustav Fischer, Jena, 1925.

This book originated from a series of lectures delivered by the author in the winter 1923-24 at the University of Brunn. It gives an exhaustive review of the Science of ecology and of causal plant geography, and described the author's investigations and the results of experimental work carried out at the ecological station " Hallands Vadero " (Sweden) established by the author. The various problems are studied from a physiological standpoint, and the author attempts to formulate certain general physiological laws, especially the law of the relativity of factor action.

It is impossible to render full justice to this exhaustive book in a short space. After a historical introduction the principal chapters deal with the factors of light, temperature, water, the soil according to its structure and general ecological properties, the physical character and the ventilation of the soil, the chemical factors of the soil, the micro-organisms of the soil, the carbonic-acid factor, the main principle of experimental ecological investigation. Each one of these chapters is subdivided into a large number of sections.

The criticism of a scientific work, like the present, cannot and must not have for its object the picking out, from the whole mass of material, of one or other view of the author with which one does not agree ; on the contrary such a work must be looked upon as a whole. Taking that view, it may be concluded that this is a work of great scientific value, which should not be missing from the library of any soil-science, geographical, botanical or other Institute. The whole book, and also the illustrations and figures are excellent.

SCHUCHT.

The Afforestation of Calcareous Soils especially by the Speckled Alder and the Black Spruce, in the Forest District of Göttingen.

STASSEN and BEIJRISCH Uber Aufforstungen ueber Kalködland. *Zeitchrift für Forst- und Jagdwesen* Year 57. pp. 483-491.

From the chemical part of the paper, particularly from the data relating to the hydrochloric acid soil extracts, the following conclusion can be drawn that, the soils covered by the speckled alder are much richer in nitrogen than those covered by the black spruce. These results probably have some relation to the well known fact of the enrichement of the alders in nitrogen by nodule bacteria, and it is of interest to have some quantitative results. Amongst the nitrogen data given are the following :

Nitrogen content.

Rock	Bare land	Covered by black spruce	Covered by speckled alder
Muschelkalk 0.020	5 cm. depth 0.103	5 cm. depth 0.167	5 cm. depth 0.345
	5-20 cm. depth 0.037	5-20 cm. depth 0.092	5-20 cm. depth 0.178

GROSSKOPF.

The Fertility of the Soil in Relation to Soil Acidity.

VITINS, J. (WITYN, J.), Riga, 1924, pp. 80. (Latvian).

The author discusses the importance in the growth of plants, of the factors, air, water and mineral foodstuffs. As a result of numerous investigations he concludes that these factors by changing the reaction character of the soil from neutral to acid, impair the growth conditions of the plant. Thus, e.g the minimum water capacity (KOSSOWITSCH) of "podsol" upper layers is much smaller than the minimum water capacity of the lower layers. The minimum water capacity of very fine grained "*Gleys*" was only 30 %, while the minimum water capacity of the very loose marl was, in one case, as high as 46 %. Also, the capillary water rise in podsol layers is smaller even than the rise in the case of the very finely grained marl-loams. Plants suffer from a water shortage mostly when growing on podsol soils, when the latter become acidic. The acid reaction of the soil injures particularly the ability of the plant to utilise phosphoric acid and nitrogen, as GEDROIZ proved again and again in his plant experiments. Numerous field experiments show that the Latvian soils contain only minimum quantities of phosphoric acid and nitrogen and the main cause is the lime shorttage. The acid soils contain larger quantities of difficultly decomposable organic substances andof phosphoric acid than those soils, which, formerly strongly acid lost their acidity through cultivation. The author mentions several very fertile soils which at present contain only 0.03-0.05 % of P_2O_5 and which without any phosphoric acid fertiliser whatsoever give very high yields, although the very same soils were previously strongly acid. In the acid soils the P_2O_5 content is 0.1-0.2 %.

The K_2O absorption also is impaired in acid soils, as can be seen best in the so called "*Gley*" soils rich in lime. In the case of these soils also, cases are known in which liming causes an improved utilisation of potassium (as determined by the grain weight without lime fertiliser).

The author mentions gypsum as the cheapest source of sulphur. It is probable that podsol soils suffer from a sulphur deficiency, since cases are known where superphosphate fertilisers gave much better results than basic slag, although the investigated soils belonged to that type on which crude phosphates act very beneficiently.

In the opinion of the author the so-called "active" acidity can impair the growth of a plant only to a very slight extent and only when it is growing on a light, lime-deficient soil. The lime content of heavy soils and of low moors is relatively high and hence their active acidity cannot be very high (buffer action). However, on these soils the roots of plants suffer from a nitrogen deficiency, even when the soil shows a low acidity. The author concludes that the yield from a plant is not determined by the abundance of food material in the soil, but by the physical and chemical properties of the soil. The same conditions determine the amounts of fertilisers required. To secure better crops from poor soils special attention must be paid to liming. By diminishing acidity of these poor soils and even with the same quantities of fertilisers the crops can be increased from two to five times.

L. FREY.

The Decline in Growth of Pines in the Middle and Lower Levels of the State Forests of Saxony.

WIEDEMANN. E Zuwachsrückgang und Wachstumsstockung der Fichte in den mittleren und unteren Höhenlagen der sächsischen Staakforsten. Akademische Buchhandlung W. Laux. Tharandt, 1925.

The book is subdivided into three main sections and deals with the causes of the decline in growth of the pine, its relation to weathering, and finally with the means to overcome the stoppage of growth. The bock is subdivided into the following sections:

A. The causes of the growth decline in the Saxonian pine forests. (1) The proof of a growth decline; (2) the growth stoppage in the investigated region; (3) climatic causes of the growth decline; (4) changes in the soil conditions and the humus layer; (5) other injurious causes.

B. Single investigations. (1) The sensitiveness to dryness of other wood varieties; (2) The growth of pines in the period 1911-22, and weathering.

C. The experiments in Saxony on overcoming the decline in growth of pines. (1) General. (2) Precautions taken by the felling authorities in Saxony. (3) Other curative measures. Conclusions.

L. G

Regional Soil Science.

Analyses of Soil Types of Troup County.

Bulletin of the Georgia State College of Agriculture, Vol. IV, No. 2, pp. 28. Athens Georgia, 1915

The soils of Troup County belong wholly to the Piedmont Plateau. The following types of soils occur: sandy loams of the Durham, Congaree and Cecil series, and loams and clays of the Cecil, Louisa, Irdell, Congaree and Altavista series. Food material and acid analyses were made of all soils.

HELLMERS.

Analyses of Soils of Dougerthy County.

Bulletin of the Georgia State College of Agriculture, Vol. 5, No. 17, pp 37, 3 illustrations. Athens, Georgia. 1919.

Dougerthy County lies wholly in the coastal plain. Only a narrow strip in the East belongs to the Grey Sandy Loam division and the rest belongs to the Red Belt. The soil is composed of the gravel and sandy loams of the Greenville, Orangeburg, Tifton, Norfolk, Sesquehanna, Grady, Cahaba and Thompson series, of the sands of the Norfolk series and of the clays of the Greenville and Grady series. In addition are found large swamps, especially along the Coolewahee river and the Chickasawhackee river. The soils of these swamps are coloured black by large masses of organic matter to a depth of 9-12 inches. In appended tables are given the results of food material analyses of all soils.

HELLMERS.

Analyses of Soils of Polk County.

Bulletin of the Georgia State College of Agriculture, Vol 5, No 18 pp. 55, figs. 5 Athens, Georgia, 1921

The greater part of the soil of the Polk County belongs scientifically to the limestone valleys of the north-west of Georgia, a small part in the East belongs to the Appalachian's and a part in the South to the Piedmont-Plateau. Among its soils the Talladega series are represented by shale, gravel and clay limes, the Louisa series by gravel and fine sandy loams, the York series by loam, the Decatur series by clay and stoney loams, the Hagerstown series by gravel, fine sandy and ordinary loam, the Clarcksville series by stoney, gravel and ordinary loam, the Colbert series by fine sandy loam, and the Christian, Arnuchee, De Kalb, Hanceville, Elk, Holston, Huntington and Gongaree series by gravel, stoney and sandy loams. In appended tables are given the results of plant food material analyses of these soils, together with the results of acid analyses.

HELLMERS.

Analyses of Soil of Jasper County.

Bulletin of the Georgia State College of Agriculture. Vol. 7, No 6, pp. 46, plates 3 Athens, Georgia, 1918.

The soils of the Jasper county belong wholly to the Piedmont Plateau type. Among the soils are represented the Davidson series by loam, the Cecil series by stoney-sandy loam, sandy loam and sandy-clay loam, the Durham, Appling and Wilkes series by sandy loam, the De Kalb series by stony-sandy loam, the Louisa series by clay loam, the Molena series by sandy loam and the Congaree series by fine sandy loam and slimy-clay loam. All soils were examined for plant food material content and acidity.

HELLMERS.

Analyses of Soils of Crisp County.

Bulletin of the Georgia State College of Agriculture, Vol 8, No. 3, pp. 30, 1 map. plates 3 Athens, Georgia, 1919.

Crisp County belongs wholly to the coastal plain. The main part of its soil belong to Grey Sandy Loam, a sub-division of the coastal plain, and only a narrow strip in the West belongs to the Red Belt. The Norfolk and the Tifton series are represented by sand and sandy loam, and the Greenville and Orangeburg series are represented by sandy loam. The Auston series is represented by loamy sand and sandy loam, the Sesquehanna, Plummer and Grady series are represented by sandy loam, the Kalmia and Myatt series by fine sandy loam and the Congaree series by silt loam. Appended tables give the potash, phosphoric acid, nitrogen and-lime content of these soils as well as the results of acid analyses. HELLMERS.

Analyses of Soils of Pierce County.

Bulletin of the Georgia State College of Agriculture, Vol IX, No 9, pp 36, 1 map, 3 plates. Athens, Georgia, 1921

Pierce County lies wholly in the region of soils of the coastal plain. The soils in the north-west belong to the Grey Sandy Loams type, the remaining soils belong to the "Flatwood" type. Sands are found in the Norfolk, Plummer, Blanton and Leon series and sandy loams in the above mentioned series and also in the Myatt, Kalmia, Susquehanna and Tifton series Besides these soils large tracts of the County are occupied by swamps, especially along the rivers Appended are the results of food material and acidity analyses of all soils except the swamps HELLMERS.

Analyses of Soils of Wilkes County.

Bulletin of the Georgia State College of Agriculture. Vol. IX, No. 10, pp. 39 plates 2 Athens, Georgia, 1920

All soils of the Wilkes County belong to the Piedmont Plateau type. The Cecil series is represented by sandy and stonsy loams and clays. the Appling series is represented by sandy loams and the Congaree series by sandy and clay loams. All soils were analysed as to their potash, phosphoric acid, nitrogen and lime contents and also a determination of the acidity of each soil was carried out. HELLMERS.

Analyses of Soils of Floyd County.

Bulletin of the Georgia State College of Agriculture, Vol. XI, No. 15, pp. 70, Athens, Georgia, 1923

Floyd County lies wholly in the region of limestone valleys. The soil consists mainly of loams. Clay loams are represented by the Decatur, Hagerstown, Frederick, Christian, Monterallo, Greenville and

Cumberland series, while gravel and stony loams are represented by the Huntington, Jefferson, Allen, Norfolk, Greenville, Hanceville, De Kalb, Shackelton, Monterallo, Frederick and Clarcksville series. Fine sandy loams are found in almost every one of the above mentioned series. In the northerly and north-westerly parts are found in addition pure stony soils. Appended are results of plant food material analyses of all the above soils.

HELLMERS.

Analyses of Soils of Burke County.

Bulletin of the Georgia State College of Agriculture, Vol. XIII, No. 5, pp 39, 1 map, 2 plates. Athens, Georgia, 1924

The soil of Burke County in its greater part belongs geologically to the coastal plain. Only the most northerly point belongs to the Piedmont Plateau. The soils of the coastal plain are in the north, the Red Belt soils and in the South Grey Sandy Loams The varieties of sands found belong to the Norfolk, Austen and Kalmia series, while the sandy loams are represented by the above mentioned three series, together with the Tipton, Orangeburg, Greenville, Susquehanna, Grady, Kalmia, Leaf and Myatt series A fine sandy loam of the Congaree series is also found. Along th rivers and brooks are found swamps. A series of tables gives the results of food material analyses of the above soils.

HELLMERS.

The Upper Rock Strata of White-Russia.

AFANASIEW, J *Mem de l'Institut agronomique à Gorky*, Vol. II, pp 140-154. Gorky, 1924

General survey of the rock strata

(1) Upper beds composed of different types of rocks: siliceous or non-siliceous sands (1 metre), loamy sand (Latvia) -- 1 metre; coarse-sandy loam (1 metre); loess-sandy loam (30 cms -1 metre), loess (10 metres); loams free of siliceous material (up to 0 5 metre).

(2) Middle bed. Sand, free from pebbles, coarsely stratified (from 10 cms.-1 metre).

(3) Lower bed. Moraines, the upper layers of which are usually an accumulation of siliceous detritus; in loess regions, however, they contain humus (0.5-1 metre). In the latitude of Gorky there are found two horizontal strata of moraines, but in the neighbourhood of Wilabsk there are three strata, separated from each other by layers of sand (12-15 metres thick).

The soil forming layers consists of alluvium which overlies the moraines. From these alluvium deposits depend the different horizontal layers, the properties of the different soil varieties and the division into principal agricultural regions.

All strata overlying the moraines are regarded as products separated from the moraines by the glacier waters of the regions.

Evidently the glacier streams, like the rivers of the present day,

separated out the material and deposited and accumulated it on the extensive and very varied moraine beds, adjusting themselves naturally to the topographic and hypsometric conditions of that time.

However, to get a clear picture of the whole process of deposition we must take into account the various, chronologically separated, rock beds of the different periods, as they correspond to the separate and consequent stages of the glacial period. In this respect we can distinguish the following important stages:

After the deposition of the upper layers of the moraines there followed in the latitude of Gorky, just as on the high plateau, a stationary period with predominating damp conditions Then there were formed on the upper surface of the moraines, humus containing swampy soils, and in the low lands between them peaty masses. In lower lying districts no traces of this stage have been preserved

Next followed a general rock forming period, the so-called alluvial-sea period, when a certain amount of rock was deposited; on higher lying flat parts loess and sandy soils of a loess character and in lower lying areas, sandy pebble varieties.

The next period is connected with the appearance of the last ice-period, which ended in the north-westerly parts of White-Russia and left behind beds of end-moraines together with the accompanying deposits. The other parts of White-Russia were at the same period subject to the action of glacier water. This action was of a twofold character, both erosive and accumulative

The last of the retreating ice-masses have left behind traces, particularly on lower lying parts, of sandy strips of old alluvium

The beginning of the agricultural period, when sands in the form of hills and dunes appeared, has been characterised by the wearing away and consequent removal of the sandy deposits. In regions with soils of a fine-grained character, however, especially in those with soils of a loess type the erosion processes have been continued even to the present time. AUTHOR.

The Soil Division of South-Eastern Russia.

GLINKA, K. (Rostov-on-the-Don), pp. 1-7, 1924

The author subdivides south-eastern Russia into the following regions:

(1) The region of *ordinary* black-earths (the northern part of the Don territory and perhaps the south-western parts of the District of Stavropol).

(2) The region of *southern* black-earths (the middle parts of the Don territory and the north-eastern parts of the District of Stavropol).

(3) The region of the *Azov* and of the *Lower Caucasian* black-earths (the south-western parts of the Don territory, the main parts of the Kuban territory, a large part of the District of Stavropol and part of the Terskaya territory).

(4) The region of *chestnut coloured* soils (the south-eastern parts

of the Don territory, the northern and the middle parts of the District of Astrakhan and the Government of Stavropol near Matysch).

(5) The region of *brown* soils (the limestone quarries of Astrakhan, etc.).

(6) Foothills with podsol soils (lower Caucasus). AUTHOR.

The Soil of the Kirghis Republic.

GLINKA, K pp. 1-85. Orenburg, 1923.

After a short historical introduction on the data obtained by the scientific soil investigations of the Kirghis Republic, the author gives a description of the soils and characterises, morphologically and chemically the local black-earth, chestnut, coloured soils, Solonetz and Solontschak soils. AUTHOR.

Chemical Characteristics of the Loess of the Former Cherson Province.

KROKOS, W. *Proceedings of the Scientific Research Institute of Odessa*, Vol. I, August-October, No 10-11, pp 1-17, 1924.

In the following report are given the humus CO_2 and SiO_2 content of the different loess varieties and of the moraines.

The loess is poor in humus with the exception of the soil surface. Its content varies between tenths and hundredths of one per cent, but sometimes is nil. The fossil soil contains little humus. The first upper layer of fossil soil, contains 10-0.78 %, the second layer 0 33-0.45 %, and the third 0.02 %.

The low humus content is explained by later decomposition processes.

The carbonate levels of the fossil soils show an increasing CO_2 content. Considerable variations are found in the SiO_2 content, from 63.35 % to 84.56 % in the case of the second loess type, which is the most sandy. All loess layers get less and less sandy as the distance increases from the Dnieper. In the same geological section the loess and the moraine cannot be distinguished from each other by the SiO_2 estimation. This indicates a close connection between the loess and the moraine deposits.

Each loess variety is related to the corresponding glacial epoch, and the four loess varieties of the Cherson Government indicate four glaciations on the Russian plain.

The loess of wind-borne origin could not have been formed during the glacial retreat, since the first, or uppermost loess variety is separated from the moraines by a fossil soil. The second loess variety lying underneath the moraine cannot be separated from its fossil soil. The loess may have been formed in the second half of a glaciation period, or during its stationary state, as a result of the deterioration of its fluvo-glacial deposits.

The glaciation of the Dnieper basin was the third, i. e. the last but one, and it led to the formation of the second, more sandy, loess variety.

The first loess variety was formed during the fourth glaciation, i. e. the last, which affected mainly the north-western parts of Russia and did not reach the Ukraine. AUTHOR.

The Characteristics of the Soils of the Provinces of Odessa and Nikolaew (formerly Kerson.).

KROKOS, W. Part I. *District Board of the Experiment Station*, 1922, Section I, pp 1-38. Odessa, 1923

The different kinds of loess of the Provinces of Nikolaew and Odessa were studied principally by means of artificial borings and diggings on the plateau and the upper parts of the slopes.

It was thus proved that on the investigated territory four kinds of loess can be distinguished. The first and principal variety is the wind-borne loess. In the region of development of chrystalline minerals sharp fragments of these are found, and on the terraces of the Dniester near the town of Tiraspol are found sharp fragments of Carpathian fine gravel. These facts can be explained by the action of whirlwinds which may have taken place during the deposition of the loess. The second variety is loess with intermediate layers of dune-sands ; the third variety is diluvial loess, and the fourth is fresh-water loess containing residues of fresh-water molluscs.

The sections at Voznesensk and Migaewo represent four varieties of loess with three dividing layers of fossil bodies. The different stages of loess reckoned from the top are marked by the letter L. Thus L_1 represents the first loess stage, L_2 the second loess stage, etc. The existing surface layer or the fossil soils are indicated by the letter *a*. Thus the first loess stage with overlying soil is denoted L_{1a}, the second L_{2a} etc Moraines are denoted by M.

The loess overlying the moraines is separated from the latter by an intermediate layer of fossil soil. This points to the absence of any relationship between the loess and the moraines, and indicates that this region after the disappearance of the glaciers became covered with plants which helped in the formation of the fossil soil, and that only later conditions arose which were favourable to the formation of the loess.

The depth of L_1 is half that of L_2, L_3, L_4, each taken separately, and from this the conclusion, may be drawn that the time taken in its formation was only half that of each of the separate other and older stages.

The fossil soils which separate the different loess varieties have the character of black-earth, while the soil in L_2 shows pale humus soil ; the soil in L_2 and in L_3 is coloured deep black and has a much greater thickness. These facts together with a morphological study of the loess show that on the territory of both districts a steppe was formed not later than the period of deposition of L_4 and existed uninterruptedly up to the present times. Judging from the fossil remains the steppe was originally moist (L_{3a}, L_{4a}) and became drier and drier.

At a depth of 2-4 metres the loess becomes chocolate brown and is traversed by yellow veins, branching vertically, which contain concre-

tions, incrustations and small tubes of manganese salts, and it shows a wedge-shaped clearage the surfaces of which have a brilliant almost lacquered appearance.

This chocolate-brown loess has been formed owing to water logging of the lower surfaces of the loess layer, and the subsequent articulation of the district through river-valley and ravine formation, has effected a partial drainage of it (the district) and a considerable lowering of the soil water content.

The investigations of 1920-1921 proved that L_1 of the Odessa District Province were formed in the after-loess period through an inclination of the continent towards the Black Sea. AUTHOR.

The Lime Requirements of Latvian Soils and their External Characteristics.

J. VITINŠ (J. WITYN). pp. 88 + 32, illustrated, Riga. 1924 (in Latvian).

The author discusses the importance of liming for plants and soils, the peculiarities o the podsol-forming process on different subsoils and the external characteristics of lime-requirement. The most important characteristics are:

(1) the colour of the soil, (2) the white weathering crust on the primary rocks found in the soil, (3) the texture of the soil, (4) the nature of the organic substances found in the soil, (5) the effects of dung manuring, (6) the nature of the soil section, (7) the cracking and handening of soils on drying, (8) the permeability of the soil to water, (9) rising of water, (10) the drying of the upper layers of the soil, (11) the development of the Leguminoseae and especially of clover, (12) the weeds. The extermination of weeds is particularly difficult on acid soils.

The author treats in greater detail the following liming materials: (1) burnt lime and its preparation in Latvia from dolomite; not suitable for liming and too costly (2) Spring lime is found in many places (more than 150 are known) among which are some containing 150,000 cubic metres of lime or more. The lime is of 95 % purity and in many cases reaches 99 % purity. In cases where this spring lime is found at higher altitudes it is hardened and transformed into tufaceous limestone; in the ower levels the lime is very loose, very fine grained and can be used without grinding.

(3) Sea-marl contains 50 % $CaCO_3$, but, is seldom found.

(4) Grey marl-loams contain 20-50 % $CaCO_3$ are found on the sea-coast between Windau and Libau.

(5) Light sandy boulder-clay, very common in Northern Latvia on the Devonian sandstones, contains 10-15 % $CaCO_3$, very seldom 20 % $CaCO_3$. The upper layers are lixivated and "podsoled"; found at a depth of 1-1.5 metres

(6) Heavy boulder-clays are only found in the southern and south-eastern parts of Latvia. Theupper layers are "podsoled"; found at a depth of 60-70 cm.a nd contain 15-30 % $CaCO_3$ in the upper surface, and 20 % in the middle and lower levels 4 % $MgCO_3$. The boulder-clays have been subjected to inundation and subsidiary products have been

formed. Among the latter $CaCO_3$ is found only in striated clays and garnet deposits.

(7) Garnet deposits are found only in osars and in isolated round masses. Lime is found only in a coarse form (grains larger than 1 mm.) and may reach sometimes 81 % ; the grains of Silurian limestones from Estonia are rounded and polished. Before use the garnet should be ground although it is being used quite successfully without previous grinding.

8) Striated clays. Their thickness reaches in some cases 1-3 metres. They contain 15-36 % $CaCO_3$ and the $CaCO_3$ content is highest in clays with grains of 0.005-0.05 mm. in diameter. In the heavy finely-grained red clays the $CaCO_3$ content reaches only 15 %. The striated clays are found very often over large areas. These striated clays are especially useful in the case of light, sandy soils and pastures, since they contain besides the lime, 2.5-3.0 % of K_2O. Their use on light soils is equivalent to a complete manuring, as the liming helps in the utilisation of the phosphoric acid and nitrogen.

The author gives many examples of the use of the above liming materials; in many cases the liming has been brought about unintentionally while making deeper cultivation.

In conclusion the author mentions cases when liming brings about unfavourable results, when (1) the materials used contain FeS or FeS_2 ; (2) on account of the small humus-content of the soil very little carbonic acid is evolved so that the $CaCO_3$ cannot be converted into $Ca(HCO_2)_2$; (3) too much marl has been applied to the soil ; (4) the soil suffers from a deficiency of other plant foods, mainly sulphur and phosphoric acid ; (5) the soil is excessively moist.

The publication contains 32 photographs and 18 figures.

L. Frey.

The Sands and Sandy Soil of Latvia.

J. Vitinš (J Wityn), pp 122 + 25 of German text, 50 illustrations, 6 soil sections (coloured) and 1 map Riga, 1924.

The sand deposits occupy about $^1/_3$ of Latvian territory. The greater part of these deposits was formed during the ice-age, during the retreat of the ice ; a part however, was formed at a later period by the depositing action of the rivers. Also the moraine loams of Latvia contain large masses of sand, which was brought about by the admixture of the sands of the Silurian and Devonian formations during the ice-age.

Large masses of sand are found in the neighbourhood of Riga and of Mitau, and where, even at the present time, the three greatest Latvian rivers, the Dvina, the Liv and the " Kurland " Aa, deposit large amounts of sand. Large deposits are found also in the neighbourhood of Windau, on the sea coast and also further inland.

The mechanical composition of the sand is characterised by the presence of a large proportion of grains of 0.05-0.25 mm. size. In some sands about 98 % of the grains are of that size, and in no case is the percentage smaller than 80. Clay particles (0.01 mm.) occur in the sands very seldom and never to a greater proportion than 6-8 %.

The chemical composition of the sands is quite different from that of the Finnish sands or of the sands of the district of St. Petersburg. The Latvian sands were derived from the latter sands. The Latvian Sands are characterised by a much smaller K_2O and Na_2O content ; thus the K_2O content of Finnish sands is 2.05 % (FROSTERUS), of the sands of the district of St. Petersburg (WITYN) is 2.61 % and of the Latvian sands is 1.02-1.38 % The corresponding Na_2O contents are 2.69 %, 1.85 % and 0.20-0.52 %. They do not contain $CaCO_3$, which is explained by the lower resistance of limestone to crushing and grinding forces. The P_2O_5 content of the deeper lying sands is 0.05 %, and only in a single case was 0.0027 % found.

The sandy soils are mostly covered by forests of classes I-V, the central part being of class III, and heaths are found where the growth of forests would be too difficult.

The quality of the forests, as well as the usefuloness of the soil for agriculture is related very closely to the degree and the character of the podsol forming process. The development of the forests is mainly conditioned by the depth of the local rock level ; with a rock depth of 30-50 cm. the forest development is still satisfactory, but with a depth of 5-15 cm. it is very poor. In such cases the roots of pines do not grow to any depth, but develop horizontally The mother rock contains about 0.4-0.6 % $CaCO_3$ and has a thickness of about 1 cm.

It is not probable that these soils will improve without liming, as the CaO content of the sand and of the subsoil, soluble in hot 10 % hydrochloric acid, is barely 0.01-0.05 %. Even the soils under forests of the first class are strongly " podsoled " The author is of opinion that a slight diminution in the acidity of the soils would have a very beneficial effect on the pines. The solution of this question in practice is of great difficulty, since account has to be taken of the presence in the soil of various organic substances and of the changes undergone by them, as they and their changes influence profondly the acidity of the soil. Probably good results could be obtained by the application of small quantities of $CaCO_3$, in any case by smaller quantities than those used in Jutland for the heath soils (60,000 kgs $CaCO_3$ per hectare). The author recommends spring lime as the most suitable liming material for forests soils, and striated clay, on account of its large K_2O content, for agricultural soils. L. FREY.

Nomenclature and Classification.

The Division of Bavaria into Economic Units on the Basis of its Geological and Soil-scientific Conditions.

NIKLAS, H. and POLT, H Die Einterlung Bayern in Wirtschaftsgebiete auf Grund der geologisch-bodenkundlichen Verhältnisse. *Zeitschrift des Bayerischen statistischen Landesamtes*. Nos 3 and 4, 1924.

The authors have divided Bavaria, from a geological point of view, into 33 economic units, and these are subdivided into 434 seed-sowing

units. From tables it can be seen how many districts fall into every one of the units, what the average climatic conditions are for each unit and what the current conditions for cultivation in each unit are. Finally they determine for each unit the average crop for five years in the case of the more important varieties. Of primary importance for the work were, the soil map of Bavaria prepared by H. NIKLAS and published by the *Zeitschrift des Bayerischen Statistische Landesamtes*, and the atlas: "*Bayerns Bodenberwitschaftung unter Berücksichtigung der geologischen und klimatischen Verhältnisse*", prepared by the same author and published in 1917 by the "Statistisches Landesamt". NIKLAS.

The Districts of the Department of the Isère.

ROY, H. The district round Grenoble, pp. 501-520. Grenoble, 1925

I. The alpine district of the Haut-Dauphiné. The crystalline and Liass beds of Oisans and Valbonais carry fertile pastures. Only rye and potatoes are grown at altitudes above 1000 metres.

The districts of Beaumont, Mateysine and triéves are formed of Liass-schists and carboniferous strata, covered more or less by glaciers, but the marl soils are suitable for the cultivation of cereals and fodder. Oats, tares and fodder grasses are especially grown. The extensive, bare plains are occupied by sheep.

The Lower Alps of Villars de Lans and of Grande Chartreuse are composed mainly of calcareous rocks and carry pastures up to an altitude of 1000-1200 metres.

Grésivaudan. A fertile valley of the Isère, is like a well-watered garden.

II. The Outer-Alpine district or Bas-Dauphiné.

The height declines from 500 to 200 metres from the Alps in the direction of the Rhône

The Crémière at an altitude of 250-400 metres, is a Jurassic calcareous, glacial plateau; polyculture is being practised.

The Lyon plain with its fluvio-glacial, ferruginous loams, carries only extensive crops.

The cold siliceous, and heavy clay soils at an altitude of 500 metres, are muddy in winter and very dry in the summer and form the animal breeding and forestry districts.

The plateau of Chambarans, from 600 to 700 metres in altitude; is not agricultural, but carries forests and is a breeding district especially of goats and oxen.

The plains of Bièvre and of Valloise, a dry ravine of fine yellow-coloured sandy-clay soil contains enclosing rounded pebbles of the Rhône Alps. Except in the valleys, the yield of wheat and of stock is low, but the quality is exceptionally high.

The marshes of Bourgoin, rich in humus, are partly drained, and grow poplars and industrial crops.

The Balmes are the hills dominating the Rhône and bear Liass and glacial soils and is a fruit growing and dairy district.

The Roussillon terrace, has the same character and is a vine and peach growing district.

The Rhône sands are occupied by market gardening on account of the very rich soil and the climate; altitude 140 metres. The chief crops are of vines, peaches and apricots.

La Voyeraine extends on a fluvio-glacial terrace at a height of 60-70 metres above the Isère The sandy soils are used particularly for the growing of nuts for export to the United States.

On the Isère the same phenomenon is observed as in many other places, a falling off in the area of arable land and an increasing area given over to pasture, in the humid climate, especially on clay, and sandy clay soils.

The best potatoes are grown in the Alps in Trièves, Valbonnais and Oisans. The slopes exposed to the north as well as the cold soils of a schistose origin are stated to give better seed than the warm soils, such as those of a sandy natue. PIERRE LARUE.

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General Notices.

Murgoci. — On March 5, 1925, Rumania lost her most renowned geologist and agrogeologist, by the sudden death of Prof. G. MURGOCI, who by his varied and important research work and original ideas placed himself in the front rank of the leaders of science

GEORGE MUNTEAN MURGOCI was born in 1872 at Braila. His secondary education was received at Braila and Bucharest at which latter place he also attended the University. Originally he studied Mathematics, Physics and Chemistry, and then turned exclusively to the study of the natural sciences. After the completion of his University career he went to Vienna and Munich where, under G. TSCHERMAK, I. BECKE I. V. GROTH and E. WEINSCHENK he devoted himself principally to the study of petrography, and in 1899 at Munich gained the doctorate, with "magna cum laude". Returning to Rumania he joined the Rumanian Geological Institute as a geologist and made

a detailed geological map of the south-eastern Carpathians. His love of the mountains excelled even his scientific enthusiasm for the study of geology, but his great interest in soil problems led to his very successful agrogeological studies.

In 1905 the Rumanian Geological Institute established an agrogeological section of which he was Director. In 1909 he was appointed Professor of Mineralogy, Petrography and Geology at the Technical High-School of Bucharest.

Agrogeology is a science which can be studied with success only if the specialist has the opportunity to travel extensively, so as to be able to know and study on the spot, soil conditions and relations under the most varying climatic conditions. Even at the present time we do not yet possess such a description of the different soil types as would enable us to study regional soil science from books. MURGOCI satisfied these demands to the fullest extent and there are very few scientists who can possibly undertake so many journeys for study As a student he travelled over a part of Germany and in the next year visited France and England In 1904 in London, he married Dr AGNES KELLY, a highly educated lady with whom he had worked under Prof WEINSCHENK. He leaves two children, a daughter Helene, who is studying medicine, and a son RADU, who a short time ago gained a prize at Cambridge. After marriage he travelled across the United States, and worked under Prof. A. C. LAWSON and Prof E W HILGARD at the Universities of Leland and Berkeley In the various countries of Europe, he studied and learned the different methods of mapping in use. However, his repeated travels for the purpose of study, to Hungary and Russia, had a decisive influence on his soil-mapping methods, and made hin an adherent of the Russian school The soil survey map of Rumania which he submitted to the 1st International Agrogeological Congress in 1909 was constructed on general natural-science lines On it the different soil-types are grouped in zones, which form an uninterrupted continuation of the different Russian soil zones

The journeys undertaken by us together in 1907 and 1908 in south Russia and Rumania led to the calling together of the first International Agrogeological Congress at Budapest MURGOCI was one of the four whose efforts brought about the holding of agrogeological congresses (1).

At the 2nd International Agrogeological Congress at Stockolm the *Internationalen Mitteilungen für Bodenkunde* were founded and he was chosen as one of the editors, which honorary position he occupied until the journal ceased to appear. After the war he was one of the first who helped to reestablish the broken relations between the scientists of the different countries, and his efforts brought about the re-establishment of the International Congress.

At the 3rd International Congress he was elected president of the 5th International Commission for Soil Mapping, and devoted himself to this honorary office with great enthusiasm and was the author of the famous "*Memoires de la Cartographie du sol*".

(1) The letter for the assembling of an International Agrogeological Congress was signed by J. NAMOGLIGH, Odessa, G MURGOCI, Bucharest, O. TREITZ, J. TIMKO, Budadest, Director L V, LOGGY, at the Congress which took place at Budapest.

PLATE III

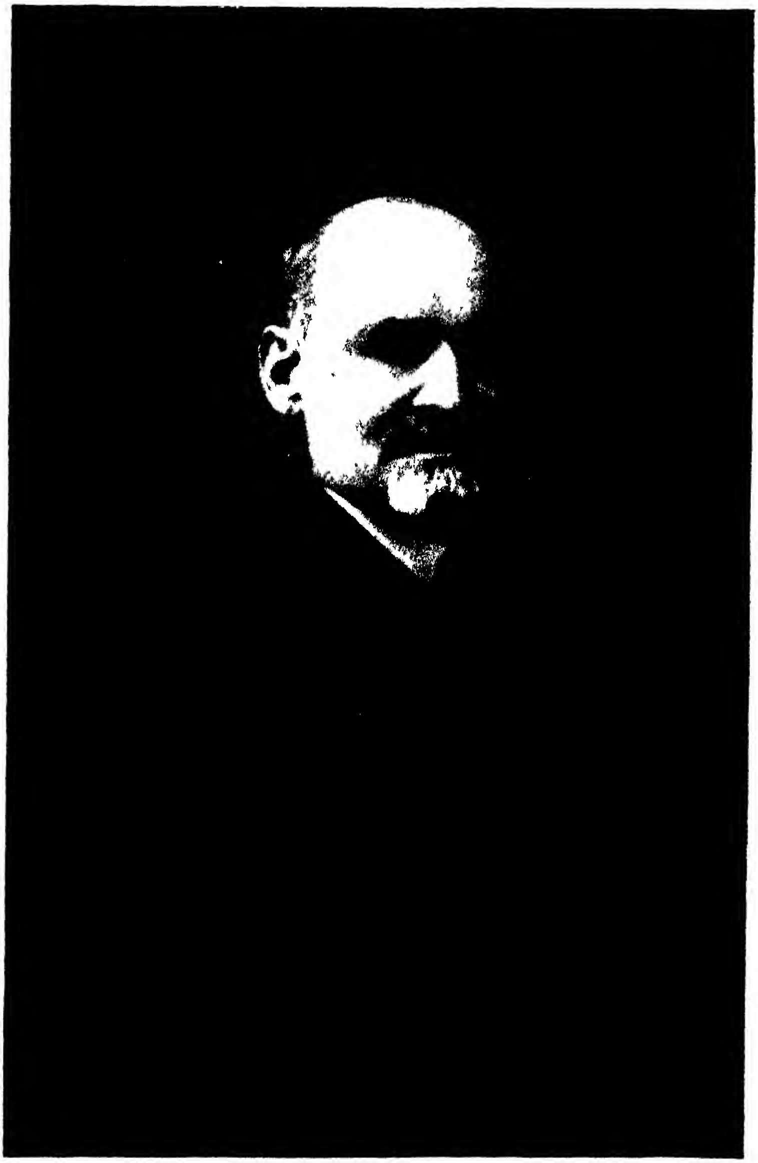


FIG. 1. — [illegible] Born at [illegible] 18[illegible], died at Bucharest May [illegible], 19[illegible]

Although already ill he devoted all his strength and energy to the edition of the " *Memoires* " and continued this work even during his illness.

He planned several volumes of the " *Memoires* " in which he intended to deal with all the different types of soil and description current in the different countries, but succeeded in publishing only one volume, so that the work was left unfinished. However, even this one volume is of lasting value as an example for future similar work. We also owe to him the first carefully worked out scientific soil nomenclature, which will serve as a basis for future developments.

The 4th International Soil-science Congress decided on the making of a soil-survey map of the whole world. For that purpose a small executive committee was formed of which he was elected Director. And again he put all his energy into the work, hoping to have the work finished before the next Congress. He prepared a sample map as an example. He did not spare his health and his illness was no hindrance to his strenuous work.

In his life, work follows work, with only short intervals for rest and even these were taken only from necessity However, fate prevented the completion of his great work and early death overtook him in the fullness of his restless activity. His tireless efforts found recognition in his election to membership of numerous scientific societies, among others to the French Academy of Science of Paris. His was one of the best known figures at all the international geological and agrogeological conferences, and owing to his knowledge of languages te always took a prominent part, his opinion in many cases being decisive Also at the last Soil-Science Congress at Rome, in 1924, he, as Chairman, although in pain, led the discussions. We all known how, owing to his co-operation and to his able chairmanship, that Congress concluded with such valuable results.

It will be difficult to replace this dear colleague whose restless activity exerted such a profound influence on our science and which won him the respect of all who could appreciate it.

He will never be forgotten by those who knew him and his work will have a lasting value. PETER TREITZ.

Prof. Ramann, President of the Soil Science Research Institute, died at Munich on the 19th of January 1926 An obituary notice will be published in the next number of this *Review*.

Communication of the Executive Committee. — As appears from the list of members published in this number the membership is now 671. This obviously involves a heavy claim on the time of the General Secretary, who is also the Treasurer. I wish therefore to repeat my appeal to members for their collaboration. Members can effectually lighten my work if they will reply at once to my enquiries whether made by letter or circular. and especially if they will send annual subscriptions without delay and, if possible in Dutch florins. enclosing the entrance fee if payable. Remittances should be sent by Post Office, Order or by payment to the " Geldersche Credit Vereeniging ", Groningen (Holland), on account ot the International Society of Soil Science.

But as I already suggested in the previous number (Vol. III, No. 3, p. 759), it is absolutely necessary that part of my work be undertaken by the National Sections. I therefore desire to urge members once more to found National Sections and to report to me the composition of the executive committees My idea is that the secretaries (or the treasurers) of these National Sections should in future assist me by being responsible for receiving new applications for membership, payment of annual subscriptions, the change of addresses, etc, reporting to me on these points and sending me the annual subscriptions in a single account

Moreover I should like to remind the members that

(1) The annual subscription for 1926 has been fixed at 6 50 Dutch florins (10 Dutch florins = about 4 Dollars)

(2) The entrance fee for new members amounts to 2 50 Dutch florins (= 1 American Dollar)

Members are requested to send the annual subcription for 1926 before 1 April 1926, with the entrance fee payable

(3) New members for 1926 who wish to obtain the four numbers of the first volume (1925) of our Journal, must apply to Dr Borghesani, International Institute of Agriculture, Villa Umberto I, Rome

(4) In this number, the list of members has been inserted Kindly inform me in *typescript* of any errors

(6) The Journal appears in 5 languages; members are asked to inform me, if necessary, in which of these 5 languages they desire to receive the Journal.

(6) In Vol III, No. 2, the rules of the Society were given Reprints may be obtained or application to myself

(7) Members intending to join one or several commissions, are requested to apply at once to the chairmen of the respective commissions As to the composition of these commissions, see Vol III No 2 (April-June 1925).

(8) Members who wish to receive the Proceedings of the Fourth International Soil Science Conference (Rome, May 1924) at the reduced price of 6 American Dollars in accordance with the new arrangements for 1926, are asked to let me know, without, however, sending the money The sums already sent by a considerable number of members have been forwarded to the International Institute of Agriculture, Villa Umberto I, Rome (Italy)

(9) Finally, I must ask members to be so good as to write in German, English, French or Dutch I regret that I am not acquainted with Italian and Spanish

A communication has just reached me from the President Dr. J. G. Lipman, to the effect that, the Organising Committee for the first International Soil Science Congress has resolved that this Congress shall be held at Washington at the beginning of June 1927. Further details will be in future communicated by the American Organising Committee.

Groningen, December 1925.

Dr. D. J. Hissink,
Acting First President
and General Secretary.

IV International Soil Science Conference, Rome. — The Organisation Committee met, with Prof. G. de Angelis d'Ossat in the chair, on 30 December in Rome, to discuss the subject of the publication of the "Proceedings". The first volume will be issued shortly by the International Institute of Agriculture, which has undertaken the publication; the other two volumes will follow The Committee fully recognise and appreciate the interest shown by the President, the General Secretary, Count R. Perotti and the active co-operation of the Bureau of Agricultural Science of the International Institute of Agriculture, as regards the publication of these "Proceedings".

List of Members of the International Society of Soil Science.

(Dated 1 January, 1926).

The countries are arranged in the French alphabetical order; the addresses are, as far as possible, quoted in the original language. The Colonies follow in each case immediately after the mother country. Under the separate countries, libraries are shown first, then institutions, societies, etc., and last of all, names of individuals; each of these groups is arranged alphabetically.

Germany.

Bibliothek der Landwirtschaftlichen Hochschule. Invalidenstrasse 42. Berlin, N. 4.

Bibliothek der Landwirtschaftlichen Institute der Universitat. Ludwig Wuchererstr. 2. Halle a/Saale.

Bibliothek der Technischen Hochschule. Munchen

Bibliothek der Universitat. Universitatsstr. 25. Marburg a/Lahn.

Bibliothek des Deutschen Kalisyndikates, G. m. b. H. Dessauerstrasse 28-29. Berlin, S. W.

Bucherei der Biologischen Reichsanstalt fur Land- und Forstwirtschaft, Berlin Dahlem.

Bücherei der Forstlichen Hochschule. Tharandt. (Freistaat Sachsen).

Staats- und Universitäts-Bibliothek. Breslau.

Universitätsbibliothek. Kiel.

Universitatsbibliothek. Beethovenstrasse, 6 Leipzig.

Universitätsbibliothek. Munchen.

Agrikulturchemisches Institut der Hochschule fiu Landwirtschaft und Brauerei (Direktor: Prof. Dr. H. NIKLAS). Weihenstephan bei München.

Agrik. Chem. Kontrollstation. Karlstrasse 10. Halle (Saale).

Agrikulturchemische Versuchsstation der Landwirtschaftskammer für die Prov. Schleswig-Holstein. (Vorsteher: Dr. Sieden). Kronshagener Weg 3, Kiel.

Badische Geologische Landesanstalt. Eisenbahnstr. 62a. Freiburg i. Baden.

Bayerische Biologische Versuchsanstalt für Fischerei. Veterinärstrasse 6. München.

Deutsches Kalysindikat G. m. b. H. (Agrikultur-Abteilung). Dessauerstrasse 28-29. Berlin, S. W. 11.

Geologische Landesuntersuchung des Bayer. Oberbergamtes. München.

Geologisches palaeontologisches Institut der Universität. Talstrasse 35. III. Leipzig.

Hessische Geologische Landesanstalt. Darmstadt.

Institut für Geologie der Landwirtschaftlichen Hochschule. Invalidenstrasse 42. Berlin, N. 4.

Kulturtechnisches Institut der Universität. Tragh. Kirchenstr. 74. Königsberg i. Pr.

Landwirtschaftliche Hochschule. Meckenheimer Allee 102. Bonn-Poppelsdorf.

Landwirtschaftliche Versuchsstation. Hornerweg 104. Hamburg. Horn.

Landwirtschaftliche Versuchsstation Limburgerhof der Badischen Anilin- und Soda Fabrik. Mutterstadt II. (Rheinpfalz).

Mineralogisch-Geologisches Institut der Technischen Hochschule. Neptunstrasse 14. Danzig-Langfuhr.

Preussische Geologische Landesanstalt. Invalidenstrasse 44. Berlin, N. 4.

Preussische Moor-Versuchsstation. Neustadtswall. Bremen.

Sächsisches Geologisches Landesamt. Talstrasse 35. Leipzig.

Staatliche Landwirtschaftliche Versuchsanstalt. (Direktor: Prof. Dr. NEUBAUER). Stübel-Allee 2. Dresden, A.

Stickstoff-Syndikat G. m. b. H. Neustädtlische Kirchenstrasse. Berlin, N. W. 7.

Untersuchungsamt der Landw. Kammer in Königsberg i. Pr. Königsberg.

ALBERT, Prof. Dr. R. Forstakademie. Brunnstr 10. Eberswalde.

BLANCK, Prof. Dr. Agrikulturchemisches Institut. Nikolausburgerweg 7. Göttingen.

BÖHM, Prof. Dr. A. Enzianstrasse 1. Berlin. Lichterfelde.

BÜLOW, Dr. Kurt von. Preussische Geologische Landesanstalt. Invalidenstrasse 14. Berlin.

BUNGERT, Dr. I. Oberförster. Kaiser-Friedrich-Ring 82. Wiesbaden.

DENSCH, Prof. Dr. Alfred Direktor des Institutes fur Bodenkunde und Pflanzenernährung der Preuss. Landwirtschaftlichen Versuchs- und Forschungsanstalten. Theaterstrasse 25. Landsberg a. W.

EHRENBERG, Prof. Dr. Paul. Hansastrasse 24. Breslau.

FAUSER, Oberbaurat Otto. (Ministerium des Innern.). Sporerstrasse 5. Stuttgart.

FISCHER, Dr. Hermann. Herzogstrasse 58 III. München.

GANSSEN, Prof. Dr. R. Königsallee 9. Berlin-Grünewald.

GEHRING, Dr. A. Landw. Versuchsstation. Braunschweig.

GÖRBING, Johannes. Dipl. Nahrungsmittelchemiker, Laboratorium für Bodenkunde und Pflanzenernährung. Borsteler-Chaussée 128. I. Hamburg, Grossborstel.

GÖRZ, Dr. R. Diplomierter Landwirt. Jagowstrasse 19. Berlin-Grünewald.

HALLER, Chemiker Dr. Hans. (Geologische Landesanstalt). Invalidenstrasse 44. Berlin, N. 4.

HÄRTEL, Dr. Fritz. (Geologe). Talstrasse 35. Leipzig.

HARRASSOWITZ, Prof. Dr. Hermann. O. Prof. der Geologie und Paleontologie, Direktor des geologischen Instituts der Universität Giessen. Ludwigstrasse 23. Giessen.

HELBIG, Prof. Dr. M. Freiburg (Breisgau).

HELLMERS, Dr. Hans. (Institut für Geologie). Invalidenstrasse 42. Berlin, N. 4.

HOHENSTEIN, Dr. Viktor. Neustädtische Kirchstrasse 9. Berlin, N. W. 7,

KRAUSS, Dr. G. Privatdozent der Bodenkunde an der Universität München. Amalienstrasse 52-0. München.

KRÜGER, Prof. Dr. h. c. E. Geheimer Regierungsrat. Alleestrasse 1. Hannover.

KUHSE, F. Technische Hochschule, Geologisches Institut. Danzig. Langfuhr.

LANG, Prof. Dr. Richard. Universitätsprofessor. Wilhelmstrasse 7. Halle a. d. Saale.

LEMMERMANN, Prof. Dr. O. Direktor des Institutes für Agrikulturchemie und Bakteriologie der Landwirtschaftlichen Hochschule. Albrecht - Thaerweg 1. Berlin. Dahlen.

MACH, Prof. Dr. F. Landwirtschaftliche Versuchsanstalt. Post Grötzingen i. B. Augustenburg.

MEYER, Dr. Diedrich, Direktor der Landw. Chem. Untersuchungsanstalten der Landwirtschaftskammer Schlesien. Matthiasplatz 6. Breslau.

MITSCHERLICH, Prof. Dr. E. A. Pflanzenbau-Institut der Universität. Tragheimer Kirchenstrasse 83. Königsberg i. Pr.

MÜNICHSDORFER, Dr. F. Landesgeologe. Ludwigstrasse 14. München.

NELLZENBRECHER, Dr. R. Rudmannstrasse 16. Salzwedel.

PFEIFFER, Prof. Dr. H. Geologische Landesanstalt. Invalidenstrasse 44. Berlin, N. 4.

PUCHNER, Prof. Dr. H. Landwirtschatliche Hochschule. Weihenstephan bei München.

RAMANN, Prof. Dr. E. Amalienstrasse 52. München.

REIHLING, Dr. rer. nat. Karl, Regierungsrat, Vorstand der Bodenkundlichen Abteilung der Württembergischen Forstlichen Versuchsanstalt. Arminstrasse 6. Stuttgart.

SCHNARRENBERGER, Dr. Carl. Landesgeologe. Badische Geologische Landesanstalt. Eisenbahnstr. 62 a. Freiburg i. Baden.

SCHUCHT, Prof. Dr. F. Güntzelstrasse 59. Berlin. Wilmersdorf.

STREMME, Prof. Dr. H. Mineralogisch-Geologisches Institut der Technischen Hochschule. Neptunstrasse 14. Danzig, Langfuhr.

TRÉNEL, Chemiker Dr. M. Geologische Landesanstalt. Invalidenstrasse 44. Berlin, N. 4.

UTESCHER, Chemiker Dr. K. Hasenmarkt 23. Spandau bei Berlin.

VAGELER, Dr. Pflanzenzuchtstation der Landwirtschaftskammer für die Provinz Ostpreussen. Ramten, Ostpreussen.

VATER, Prof. Dr. Dr. h. c. H. Geh. Forstrat. Tharandt.

WIESSMANN, Dr. Hans, Privatdozent. Werftstrasse 18. Berlin N. W. 52.

WOLFF, Prof. Dr. W. Abt. Direktor Geologische Landesanstalt. Invalidenstrasse, 44. Berlin, N. 4.

ZUNKER, Prof. Dr. Ing. F. Direktor des Kulturchemischen Institutes. Hansastrasse 25 Breslau, 116.

Austria.

Bodenkundliches Laboratorium des Landes-Meliorationsamtes. Vertreter Dr. Ing. Bernhard RAMSAUER, Landespedologe. Müllnerhauptstrasse 54. Salzburg.

LEININGEN - WESTERBERG, Dr. Wilh. Graf zu. Lehrkanzel fur forstliche Bodenkunde und forstliche chemische Technologie an der Hochschule fur Bodenkultur. Hochschulstrasse 17. Wien, XVIII.

STINY, Prof. Dr. J. Höhere Forstlehranstalt. Bruck a d. Mur.

TILL, Prof. Dr. Alfred. Lehrkanzel fur landwirtschaftliche Bodenkunde an der Hochschule für Bodenkultur. Piaristengasse 62. Wien.

Belgium.

Comptoir Belge du Sulfate d'ammoniaque. Société Anonyme. Rue Berckmans 8. Bruxelles.

SIMOENS, W. Staatslandbouwkundige. Poperinghe. West-Vlaanderen.

SYS, Maurice. Staatslandbouwkundige. Dixmuiden. West-Vlaanderen.

Cuba.

ANDERSON, E. L. Cuban Sugar Club. Apartado 1973. Habana.

FORTUN, Ir. Gonzalo M. Ingeniero Agrónomo, Director Estación Experimental Agronómico de Cuba. Santiago de las Vegas.

RAPALJE, E. H. Manager, American Agricultural Chemical Company. 553 Banco Nacional de Cuba. Habana

THURSTON, F. R. Manager, Central " Oriente ". Oriente.

WALKER, E. S. Superintendent of Agriculture. Central Preston. Preston, Province of Oriente.

ZELL, J. R. Finca " El Conde " Hershey, Province Habana.

Denmark.

Den Kgl. Veterinaer - og Landbohøjskoles. Bibliothek. Bülowsvej 13. København, V.

Afdeling for Landbrugets Plantedyrkning. Den Kgl. Veterinaer - og Landbohøjskoles. (Director: Prof. K. A. BONDORFF og Prof. E. LINHARD. Rolighedsvej 23. København,

Danmarks Geologiske Undersøgelse. (Director: Victor MADSEN). Gammelmønt 14. København, K.

Den Kgl. Veterinaer - og - Landbohøjskoles, plantefysiologiske Laboratorium, (Director: Professor Dr. H. WEIS). København, V.

Det danske Hedeselskab. Viborg.
Det Kgl. danske Landhusholdningsselskab. Vestre Boulevard 34. København, B.
Ladel und Landbrugsskoles Kemiske Laboratorium. Brørup.
Landbrugsraadet. Vestre Boulevard 4. København, B.
Statens Forsøgsstation i (Director: C. IVERSEN). Askov, pr. Vejen.
Statens forstlige Forsøgsvaesen. (Director: Prof. Dr. A. OPPERMANN). Springforbi, ved København.
Statens Havebrugs-Forsøgsstation. (Director: N. ESBJERG). Blangsted, pr. Odense.
Statens Marskforsøg. (Director: C. J. CHRISTENSEN). Ribe.
Statens Planteavls Laboratorium. (Director: CHRISTENSEN, Dr. H. C.) Lyngby.
Statens Plantepatologiske Forsøg. (Director Prof. Dr. C. FERDINANDSEN). Lyngby.

BIILMANN, Prof. Dr. E. Direktor des chemischen Laboratoriums der Universität. København.
LUND, cand. polyt. Augusta Landbohøjskolen. Bulowsvej 13. København, V.
OLSEN, Dr. Phil. Carsten Carlsberg Laboratorium. København, Valby.
RORDAM, Prof. Dr. K. Landbohøjskoles. Bülowsvej 13. København, V.

Egypt.

ABDEL-VAHID FAHMY, Effendi. Inspecteur au Ministère Egyptien de l'Agriculture. Le Caire.
MOSSÉRI, Victor M. Président de l'Institut d'Egypte. 25, Rue Cheik Aboul-el Sebaa. Le Caire.

Spain.

Estación Agronómica - Instituto Agrícola de Alfonso XII. Director Ing. Guillermo QUINTANILLA. La Moncloa. Madrid.
ALCARAZ, Excmo Sr. D. Enrique. Ingeniero Agrónomo - Profesor de la Escuela de Ingenieros Agrónomos. Juan de Mena 15, pral. A. Madrid.
ARGÜELLES, Sr. D. Ernesto de Canedo. Ingeniero de Montes y Geógrafo. Director de la Biblioteca del Instituto Geográfico. Villanueva, 43. Madrid.
BILBAO y SEVILLA Ing. Francisco, Délégué de l'Espagne dans l'Institut International d'Agriculture. Villa Umberto I. Roma (10).
DALDA de TORRE, Sr. D. Adolfo Ingeniero de Montes. De la Sección de Montes del Ministerio de Fomento. San Bartolomé 6. Madrid.
H. del VILLAR, Sr. D. Emilio. Lista 62, 3º der. Madrid.
ITURRALDE, Sr. D. Julián. Ingeniero de Montes - Profesor de la Escuela de Ingenieros de Montes. Arenal 8. Madrid.
MARCILLA, Sr. D. Juan. Ingeniero Agrónomo - Profesor de la Escuela de Ingenieros Agrónomos. La Moncloa. Madrid.

MUÑOZ, Sr. D. Juan Diaz. Ingeniero Agrónomo - Profesor de la Escuela de Ingenieros Agrónomos. Rodriguez San Pedro, 29. Madrid.

SANZ, Sr. D. José Lillo. Ingeniero de Montes. Villanueva 43 pral. Madrid.

Esthonia.

Bodenkundliches und Agrikulturchemisches Kabinett. (Leiter: A. NOMMIK). Vene uul. 28. Tartus.

United States.

Library of the Los Baños College F. O. Los Baños, Philippines.

Soil Improvement Committee of the National Fertilizer Association. Insurance Building. Washington, D. C.

AGEE, Director H. P. Director Experiment Station of the Hawaiian Sugar Planters Association. Honolulu, Hawaii.

ALBRECHT, W. A. College of Agriculture. Columbia. Missouri.

ALLEN, H. B. Experiment Station. New Brunswick. New Jersey.

ALLISON, Dr. F. E. Fixed Nitrogen Research Laboratory, Department of Agriculture. Washington, D. C.

ALLISON, Robert V. c/o Cuban Sugar Club Tropical Plant Research Foundation Central Office, 1350 B Street, Southwest. Washington, D. C.

ALWAY, F. J University of Minnesota. St. Paul. Minnesota

ANDERSON, Dr. M. S. Bureau of Soils, United States Department of Agriculture. Washington, D. C.

BALDWIN, Mark. Bureau of Soils, United States Department of Agriculture. Washington, D. C.

BARNES, E. E. Ohio State University Soil Department. Columbus. Ohio.

BARNETTE, R. M. Experiment Station. Gainesville. Florida.

BARRETT, Rollin H. Vermont State School of Agriculture. Randolph Center. Vermont.

BATES, H. R. Manager Manufacturing Department. P. O. Box 1725. Atlanta. Georgia.

BAYLOR, H. B. Sales Manager. P. O. Box 1752. Atlanta. Georgia.

BEARER, E. V. Experiment Station. New-Brunswick. New Jersey.

BECKWITH, Charles, S. Browns Mills. New Jersey.

BENNETT, H. H. Bureau of Soils, United States Department of Agriculture. Washington, D. C.

BIZZELL, J. A. College of Agriculture. Cornell University. Ithaca. New York.

BLACKWELL, C. P. 614, Rhodes Building. Atlanta. Georgia.

BLAIR, A. W. Experiment Station. New-Brunswick. New-Jersey.

BLINN, Philo K. Rocky Ford. Colorado.

BRADFIELD, Richard. College of Agriculture. Department of Soils, University of Missouri. Columbia. Missouri.

BREWSTER Benjamin H. III. 25 South Calvert Street. Baltimore. Maryland.

BROWN, B. E. Bureau of Soils United States Department of Agriculture. Washington, D. C.

BROWN, P. E. Iowa State College. Ames. Jowa.

BUCKMANN, H. O. College of Agriculture. Cornell University. Ithaca. New York.

BURGESS, P. S. University of Arizona. Tucson. Arizona.

BUTLER, Edward, jr. 20 South Delaware Avenue. Philadelphia. Pennsylvania.

BUSHNELL, T. M. Agriculture Experiment Station. Lafayette. Indiana.

CALLISTER, George J. Potash Importing Corporation of America. 81 Fulton Street. New-York, City.

CARROLL, John S. Potash Importing Corporation of America. 81 Fulton Street. New York, City.

CHAPMANN, J. E. Agricultural College. 1010 12th Avenue North. Fargo. North Dakota.

COBB, Prof. Wm. B. Associate Professor of Geology and Soils. North Carolina State College Raleigh. North Carolina

COLE, John S. Bureau of Plant Industry, United States Department of Agriculture Washington, D. C

COLLINGS, Gilbert H Clemson College South-Carolina.

CONNER, S D. Agricultural Experiment Station Lafayette. Indiana.

CONREY, Cuy W Ohio State University. Columbus. Ohio.

COX, H. R Experiment Station. New-Brunswick. New-Yersey.

DAVIS, Dr R O E Bureau of Soils, United States Department of Agriculture. Washington, D. C.

DENISON, I. A. Bureau of Soils, United States Department of Agriculture. Washington, D. C.

DULEY, F. L. College of Agriculture. University of Missouri. Columbia. Missouri

ENGLE, Mr. E B University of Nebraska.College of Agriculture. Lincoln. Nebraska.

EMERSON, Paul. Iowa State College. Ames. Iowa.

ERDMAN, Lewis W. Iowa State College. Ames. Iowa

FRED, E B. University of Wisconsin. Madison. Wisconsin.

FRENCH, Albert. International Agricultural Corporation. Room 3018, 61 Broadway. New-York, City.

FRY, W. H. Bureau of Soils, United States Department of Agriculture. Washington, D. C.

FUDGE, B. R. Experiment Station. New-Brunswick. New-Jersey.

GARDNER, Willard. Utah Experiment Station. Logan. Utah.

GILE, Philip L. Bureau of Soils-United States Department of Agriculture. Washington, D. C.

GINSBURG, J. M. Experiment Station. New-Brunswick. New-Jersey.

GLADDEN HUTTON, Prof. J. State College. Brookings. South Dakota.

GRABER, L. F. University of Wisconsin, Madison, Wisconsin.

GRAUL, E. I. University of Wisconsin. Madison. Wisconsin.

GREAVES, J. E. Utah Agricultural Experiment Station. Logan. Utah.

HARPER, J. N. Department of Crop Fertilization. 910 Citizens and Southern Bank Building. Atlanta. Georgia.

HASKELL, S. B. Massachusetts Agricultural College. Amherst. Massachusetts.

HAYES, P. A. Bureau of Soils, United States Department of Agriculture. Washington, D. C.

HEARN, W. R. Bureau of Soils. United States Department of Agriculture. Washington, D. C.

HEUKELEKIAN, H. Experiment Station. New-Brunswick. New-Jersey.

HIBBARD, P. L. University of California. Berkeley. California.

HOAGLAND, D. R. University of California. Berkeley. California.

HOLMES, Robert S Bureau of Soils, United States Department of Agriculture. Washington, D. C.

HORTON, H. E. Casco Mercantile Trust Company. Portland. Maine.

JENNINGS, D. S. Utah Experiment Station. Logan. Utah

JOFFE, J. S. Experiment Station. New-Brunswick. New-Jersey.

JONES, C. D. Experiment Station. New-Brunswick. New-Jersey.

JONES, J. S., Oregon Experiment Station, Corwallis, Oregon.

JORDAN, H. V. State College. New-Mexico.

KARUNAKER, P. D. ?

KELLEY, W. P. University of California. Berkeley. California.

KEZER, Alwin. Experiment Station. Fort Collins. Colorado.

KRAUSS, F. G., University of Hawaii. Honolulu, Hawaii.

KRIEGE, Herbert F. Ohio State University. Columbus. Ohio.

KRUSEKOPF, H. H. College of Agriculture. Columbia. Missouri.

LAPHAM, Macy H. Bureau of soils U. S. Dept. of Agriculture. Washington, D. C.

McLEAN, H. C. Experiment Station. New-Brunswick. New-Jersey.

LEE, H. R. Union Carbide and Carbon Research. Laboratories. 30. East 42nd Street. New-York, City.

LEE, Linwood L., Inc. Box 192. Moorestown. New-Jersey.

LEFEVRE, Henry E. Société Commerciale des Potasses d'Alsace. City 25 West 43rd. Street. New-York.

LESH, F. R. University of Missouri. Columbia. Missouri.

LIPMAN, J. G. Prof. Dr. Experiment Station. New Brunswick. New Jersey.

DeLOACH, R. J. H. Armour Fertilizer Works. 209. West Jackson Boulevard Chicago. Illinois.

LONG, D. D. Director Agricultural Research and Service Department. P. O. Box 1725. Atlanta. Georgia.

LOWRY, R. B. Experiment Station. Knoxville. Tennessee.

LYON, T. L. College of Agriculture. Cornell University. Ithaca. New-York.

MARBUT, Prof. C. F. Bureau of Soils. United States Department of Agriculture. Washington, D. C.

MATTSON, Dr. Sante E. Bureau of Soils. United States Department of Agriculture. Washington, D. C.

McCALL, A. G. University of Maryland. College Park. Maryland.

McCLURE, George M. Ohio State University. Soils Department. Columbus. Ohio.

McDOWELL, H. C. Armour Fertilizer Works. 209 West Jackson Boulevard. Chicago. Illinois.

McINTIRE, W. H. Experiment Station. Knoxville. Tennessee.

MEULEN, P. A. van der. Rutgers University. New-Brunswick. New-Jersey.

MEYER, A. H. University of Wisconsin. Madison. Wisconsin.

MICHEL, Paul. Kiowa. Colorado.

MIDDLETON, Dr. Howard Bureau of Soils. United States Department of Agriculture. Washington, D. C.

MILLER, M. F. College of Agriculture. Columbia. Missouri.

MOOERS, C. A. Experiment Station Knoxville. Tennessee.

MUSGRAVE, G. W. Experiment Station. New-Brunswick. New-Jersey

MYERS, W. Lambert. 1128 Hurt Building. Atlanta. Georgia.

MYERS, William S. 25 Madison Avenue New York, City.

NOER, O. J. University of Wisconsin. Madison. Wisconsin

OBER, Gustavus, Jr. Ober Fertilizer Company. Baltimore. Maryland.

OLMSTEAD, Dr. L. B. Bureau of Soils. United States Department of Agriculture. Washington, D. C.

ORTON, Dr. W. A. Tropical Plant Research Foundation. 1350 B Street, S. W. Washington, D. C.

PEARSON, H. S. Nitrate Agencies Company. 104 Pearl Street New York, City

PENDLETON, Prof. Robert L. College of Agriculture, University of the Philippines Los Baños. Philippines.

PERKINS, Alfred T. College of Agriculture Manhattan. Kansas.

PIERRE, W. H. University of Wisconsin. Madison. Wisconsin.

POWERS, W. L. Oregon Experiment Station. Corvallis. Oregon.

PRANKE, E. J., American Cyanamid Company, 511, Fifth Avenue, New York, City.

PRINCE, A. L. Experiment Station. New-Brunswick. New-Jersey.

REED, E. P. Ohio State University Columbus. Ohio.

RICE, T. D. Bureau of Soils. United States Department of Agriculture. Washington, D. C.

ROBBINS, W. R. Experiment Station. New-Brunswick. New-Jersey.

ROBERTSON, David W. Experiment Station. Fort-Collins. Colorado.

ROBINSON, William O. Bureau of Soils. United States Department of Agriculture. Washington, D. C.

RUPRECHT, R. W. Experiment Station. Gainesville. Florida.

RUSSELL, J. C. University of Nebraska. College of Agriculture. Lincoln. Nebraska.

SALTER, Robert M. Ohio State University. College of Agriculture. Columbus. Ohio.

SAMPSON, H. O. Experiment Station. New-Brunswick. New-Jersey.

SCHREINER, Oswald. Soil Fertility Investigations, Bureau of Plant Industry. United States Department of Agriculture. Washington, D. C.
SHAW, Prof. Chas. F. 320, Hilgard Hall. Berkeley. California.
SHAW, W. M. Experiment Station. Knoxville. Tennessee.
SHIVE, J. W. Experiment Station. New-Brunswick. New-Jersey.
SHOREY, R. C. Bureau of Plant Industry. United States Department of Agriculture. Washington, D. C.
SILBERT, Doroty. West 7th. Street 954. Plainfield. New-Jersey.
SKUDERNA, A. W. Rocky-Ford. Colorado.
SMALLEY, H. R. Soil Improvement Committee National Fertilizer Association, 616 Investment Building. Washington, D. C.
SMITH, A. M. University of Maryland. College Park. Maryland.
SMITH, R. S. Department of Agronomy, University of Illinois. Urbana. Illinois.
SNYDER, Robert Miflin. College of Agriculture. East-Lansing. Michigan.
SPRAGUE, H. B. Experiment Station. New-Brunswick. New-Jersey.
SPURWAY, C. R. College of Agriculture. East-Lansing. Michigan.
STARKEY, R. L. University of Minnesota. Department of Bacteriologie. Minneapolis. Minnesota.
STEPHENSON, R. E. Oregon Experiment Station. Corvallis. Oregon.
STEVENSON, W. H. Iowa State College. Ames. Iowa.
STEWART, H. W. University of Wisconsin. Madison. Wisconsin.
TRUOG, E. University of Wisconsin. Madison. Wisconsin.
TURRENTINE, J. W. Bureau of Soils. United States Department of Agriculture. Washington, D. C.
WAKSMAN, S. E. Experiment Station. New-Brunswick. New-Jersey.
WALSTER, H. L. North Dakota Experiment Station, Agricultural College. North-Dakota.
WARD, Justus C. Rocky Ford. Colorado.
WEIR, W. W. Bureau of Soils. United States Department of Agriculture. Washington, D. C.
WHITE, J. W. Pennsylvania State College. State-College. Pennsylvania.
WHITING, A. L. University of Wisconsin. Madison. Wisconsin.
WHITSON, A. R. University of Wisconsin. Madison. Wisconsin.
WHITTLE, C. A. 614 Rhodes Building. Atlanta. Georgia.
WIANCKO, A. T. Agricultural Experiment Station. Lafayette. Indiana.
WILLIS, L. G. Experiment Station. Raleigh. North Carolina.
WILSON, A. M. Department of Soils. University of Missouri. Columbia. Missouri.
WILSON, B. D. College of Agriculture. Cornell University. Ithaca. New York.
WOLFE, T. K. Virginia Agricultural Experiment Station. Blacksburg. Virginia.
WRIGHT, W. H. University of Wisconsin. Madison. Wisconsin.

Finland.

Finska Mosskulturföreningen, (Finnischer Moorkulturverein). Helsinki.
Helsingin Yliopiston Naanviljelyskemiallinen laitos. (Praeses: Prof. Dr. J. VALMARI). Helsinki. Suomi.
Maatalouskoelaitos, Maanviljelyskemian jafysiikan osasto. (Landwirtschaftliche Versuchsstation, Abteilung für Agrikulturchemie und Physik) Vorstand: J. VALMARI. Tikkurila.
Statens Markforskningsinstitut (Staatliches Bodenuntersuchungsinstitut). Vorsteher: Dr. B. FROSTERUS. Boulevardsgatan 29. Helsinki.
AALTONEN, Dr. V. T. Professor der Bodenwissenschaft an der Forstlichen Versuchsanstalt Finnlands. Tunturilaaksonk 17 B. Helsinki. Suomi.
AARNIO, Dr. B. Staatliches Bodenuntersuchungsinstitut, Boulevardsgatan 30. Helsinki.
AUER, Dr. Väinö. Dozent. Fredrikinkatu 66 B. Helsinki. Suomi.
BRENNER, Widar. Geologiska Kommissionen I. Boulevardsgatan 29. Helsinki.
FROSTERUS, Dr. Benj. Staatliches Bodenuntersuchungsinstitut. Boulevardsgatan 29. Helsinki.
KOKKONEN, Dr. Pekka. Fredrikinkatu 66 B. Helsinki. Suomi.
SALMINEN, Phil. mag. Antti. Fredrikinkatu 64, A, II. Helsinki.

France.

ANDRÉ, Prof. Gustave. Professeur à l'Institut agronomique. Boulevard Raspail 120. Paris (6).
BRIOUX, Ch. Directeur de la Station agronomique. Rue Blaise-Pascal 36. Rouen. Seine Infér.
CAYEUX, L. Professeur au Collège de France et à l'Institut national agronomique. Place Denfert-Rochereau 6. Paris (14).
GRANVIGNE, Dr. Charles. Ingénieur agronome, Directeur de la Station agronomique régionale du Dyon. 14, Avenue Victor Hugo. Lyon (Côte-d'Or).
WINOGRADSKY, Prof. Dr. S. Institut Pasteur. Brie-Comte-Robert. Seine-et-Marne.

Irish Free State.

HALLISSY, Dr. I. Geological Survey Office. Humestreet 14. Dublin.

Great Britain.

Library of the Rothamsted Experimental Station. Harpenden.
Library of the School of Agriculture. Cambridge.
Library of the West of Scotland Agricultural College. 6 Blythswood Square. Glasgow.
BOSWELL, Prof. P. G. J. Department of Geology. The University. Liverpool.

CLARKE, G. R. School of Rural Economy. University of Oxford. Oxford.
COMBER, Prof. N. M. Agricultural Department. The University. Leeds.
COWIE, G. A. Potash Syndicate. 39, Victoria Street, Westminster. London, S. W. I.
CRANFIELD, H. T. Midland Agricultural and Dairy College. Sutton Bonington. Loughborough.
CROWTHER, E. M. Rothamsted Experimental Station. Harpenden. Herts
CUTLER, D. W. Rothamsted Experimental Station. Harpenden. Herts.
DAVIES, W. Morley. Harper Adams Agricultural College. Newport. Salop.
DIAMOND, T. S. School of Agriculture Cambridge.
ELLIS, J. C. B. School of Rural Economy. University of Oxford. Oxford.
FAGAN, T. W. Agricultural Buildings. University College of Wales. Aberystwyth.
GANGULEE, Prof. N Rothamsted Experimental Station. Harpenden. Herts.
HANLEY, Dr. J. A. Agricultural Advisory Office. 22, Berkeley Square. Bristol.
HENDRICK, Prof. J. Marischal College Aberdeen.
HOBSON, R. P. Rothamsted Experimental Station. Harpenden. Herts.
JONES, H. I. Advisory Chemist. Department of Agriculture. The University. Leeds.
KEEN, Dr. B. A. Rothamsted Experimental Station. Harpenden. Herts.
LEAF, C. S. School of Agriculture. Cambridge.
LING, A W. Agricultural Advisory Office 22, Berkeley Square. Bristol.
MILNE, G. The University. Department of Agriculture. Leeds.
MORISON, C. G. T. School of Rural Economy. University of Oxford. Oxford.
NEWLANDS, G. Marischal College. Aberdeen.
OGG, W. G. Soil Advisory Officer, Edinburgh and East of Scotland College of Agriculture. 13, George Square Edinburgh.
PAGE, H. J. Rothamsted Experimental Station. Harpenden. Herts.
POLLARD, A. G. Chemical Department. Imperial College of Science and Technology. London, S. W. 7.
PRIESTLEY, R. W. School of Agriculture. Cambridge.
PURI, Dr. A. M. Rothamsted Experimental Station. Harpenden. Herts.
ROBINSON, G. W. University College of North-Wales Department of Agricultural Chemistry. Bangor.
RUSSELL, Sir E J. Director Rothamsted Experimental Station. Harpenden. Herts.
SAINT, S. J. The University. Department od Agriculture. Leeds. H.
SANDON, H. Rothamsted Experimental Station. Harpenden. Herts.

SCOTT ROBERTSON, G. Chemical Research Division Queen's University. Belfast.

SKINNER, C. E. Rothamsted Experimental Station. Harpenden. Herts.

THORNTON, H. G. Rothamsted Experimental Station. Harpenden. Herts.

WALLACE, T. Agricultural and Horticultural Research Station. Bristol. Long Ashton.

WILLIAMS, RICE. Department of Agriculture University College of North Wales. Bangor.

WILSON, T. O. Harper Adams Agricultural College. Newport. Salop.

India.

FOWLER, Dr. G. Consulting Chemist. Nasik. Bombay Presidency.

HOWARD, A. Institute of Plant Industry. Indore. Central India.

TAMHANE, V. A. Soil Physicist to the Government of Bombay. Dist. Poona. Manjri Farm. Bombay.

West Indies.

Library of the Imperial College of Tropical Agriculture Trinidad.

HARDY, Prof. F. Imperial College of Tropical Agriculture. Trinidad.

Sudan.

JOSEPH, Dr. A. F Wellcome Tropical Research Laboratories. Khartoum

Australia.

Library of the University of Adelaide. Glen Osmond. South Australia.

KEN, H. W. Bureau of Sugar Experiment Station. Agricultural Department Brisbane. Queensland.

PRESCOTT, Prof. J. A. Waite Agricultural Research Institute. University. of Adelaide. Glen Osmond. South Australia.

Canada.

Library of the Dominion Chemist Central Experimental Farm Ottawa.

ELLIS, J. H. Manitoba Agricultural College. Winnipeg.

JONES, D. H. Department of Bacteriology, Ontario Agricultural College. Guelph. Ontario.

LOCHHEAD, A. G. Dominion Bacteriologist. Central Experimental Farm. Ottawa.

NEWTON, J. D. University of Alberta. Edmonton.

WYATT, F. A. University of Alberta. Edmonton.

New Zealand.

RIGG, T. The Cawthron Institute. Nelson.

South Africa.

Division of Chemistry of the Department of Agriculture. Pretoria.
MALHERBE, B. A Ph. D. I. de V. Professor voor Landbouwchemie de Universiteit Stellenbosch. Stellenbosch.

Greece

Ecole Supérieure Forestière. Rue Michel Woda 26. Athènes.
Société Hellénique d'Agriculture. Rue de l'Université 53. Athènes.
GEORGALAS, Prof. Dr. Georges C. Directeur du Bureau géologique de Grèce. Ministère de l'Economie Nationale Rue Sepolion 156 Athènes.
LIATSIKAS, Dr. Nik. Agrogéologue du Bureau géologique de Grèce. Ministère de l'Economie nationale Athènes
MICHALOPOULOS, Dr G M. Themistokleous 4 Athènes
PALIATSEAS, Photios G Director of the Central Agricultural Laboratory. Athènes
RENIERIS, Dr. Const Rue Manis 6. Athenes.

Honduras.

MAGISTAD, Oscar C. Tela Railroad Company. Tela.

Hungary

Institut fur Ökonomische Geologie an der Universitat (Vorsteher: Prof. Dr. L. v Lóczy) Esterhàzy u 3 Budapest, VIII.
Königl. Ung. Geologische Reichsanstalt Stefània - út 14-16. Budapest, VII.
Landes - Chemisches Institut. Kelety - Kàroly - ùtca 24 Budapest, II.
BALLENEGGER, Prof. Dr. Robert. Prof. fur Bodenkunde an der Kön. ung. hoh. Lehranstsalt fur Gartenbau, Dozent an der Universität. Vérmezö-út 16. Budapest, I.
DICENTY, Dr. Desider. Direktor des K. ung. Ampeologischen Institutes. Debroi - út 15. Budapest, I.
DOBY, Prof. Dr. Géza. Direktor des Agrochemischen Institutes der Volkswirtschaftlichen Fakultat. Szerb-útca 21. Budapest, IV.
GYORFFY, Dr. Stephan. o. ö. Professor an der Universität. Iskola-útca 29. Szeged, I.
KREYBIG, Dr. Ing Ludwig von. Ingenieurchemiker. Cserhatsurány. Nográdmegye.
MAROS, Dr. Emerich. K ung. Geologe Reichsanstalt. Stefánia - út. 14-16. Budapest, VII.
PINKERT, Sigmund, Seminar Direktor. Damjanich ú. 28-a II. 19. Budapest, VII.

SALACZ, Dr. Ladislaus. K. ung. Adjunkt am K. ung. Ampeologischen Institute. Debröi - út 15-17. Budapest, II.

SCHERF, Ing. Emil, Ingenieurchemiker, Technische Hochschule, Chemisch. Labor. d. geol. Lehrstuhles Muegyetem, Hptg. 52, Budapest 1.

'SIGMOND, Prof. Dr. A. von. Technische Hochschule. Muegyetem, Mezögazd. chem. techn. tanszék. Szent - Gellérttér. 4. Budapest, I.

TIMKO, Dr. Emerich. K. ung. Chefgeologe und Oberbergrat, K. ung. Geologische Reichsanstalt. Stefánia - út. 14-16. Budapest, VII.

TREITZ, Peter. K. ung. Agrochefgeologe und Oberbergrat, K. ung. Geologische Reichsanstalt. Stefánia - út 14-16. Budapest, VII.

ULICSNY, Kartl. K. ung Inspektor am K. ung. Ampeologischen Institute. Debroi - út. 15. Budapest, II.

VAJDA, Ing. Edmund Privatdozent an der Technischen Hochschule. Bimbó - útca 6-a. Budapest, II

VITÁL, Anton. Horer an der Technischen Hochschule. Nyál - útca 11 Budapest, II

Italy

Direzione Generale dell'Agricoltura Direttore Generale Prof. Gr. Uff A. BRIZI. Via Venti Settembre 18 Roma

R Istituto Superiore Agrario. Gabinetto di Geologia Direttore: Prof. Dr. G. DE ANGELIS D OSSAT Perugia.

Unione delle Cattedre ambulanti di Agricoltura Italiane, Direttore Generale Prof. Enrico FILENI. Piazza Montecitorio 115 Roma.

AVATTANEO, Prof Romualdo Via Lucullo 3. Roma.

BORGHESANI, Dr. G. A. R Chef du Service scientifique agricole. Institut International d'Agriculture Villa Umberto I Roma (10).

CAUDA, Prof. Adolfo. R. Istituto Tecnico Asti.

CREMA, Ing Dr. Camillo Geologo Capo. R. Ufficio Geologico, Via Santa Susanna 13. Roma

DE ANGELIS D'OSSAT, Prof. G. De. Via Calatafimi 21. Roma (21).

DE CILLIS, Prof. Emanuele R. Istituto Superiore Agrario. Portici (Napoli).

Del PELO PARDI, Ing. Giulio Piazza Mattei 10. Roma.

GIORDANO, Prof. Federigo. Direttore dell'Istituto di Meccanica Agraria. Piazza Cavour 4. Milano

GIOVANNONI, Ing. Ernesto. Via Torino 135. Roma.

MUNERATI, Prof. Ottavio. Direttore della R. Stazione di Bieticoltura. Rovigo.

NEPPI, Prof. Carlo. Direttore della Cattedra Ambulante di Agricoltura. Ferrara.

PANTANELLI, Prof. Enrico. Direttore della Stazione sperimentale di Aridocoltura. Bari.

PEROTTI, Prof. Dr Conte R. R. Stazione di Patologia Vegetale. Via Santa Susanna 13. Roma.

PEYRONEL, Prof. Beniamino. Vice Direttore della R. Stazione di Patologia Vegetale. Via Santa Susanna 13. Roma.

PINOLINI, Prof. Domenico. Direttore della Cattedra Ambulante di Agricoltura. Mahcerata.
PRATOLONGO, Prof. Ugo. R. Istituto Superiore Agrario. Laboratorio di industrie agrarie. Milano.
RAINERI, Dr. Luigi. Delegazione per la Propaganda del Nitrato di Soda. Via Venti Settembre 58. Roma.
ROSSI, Dr. Prof. Giacomo. R. Istituto di Batteriologia Agraria. Portici (Napoli).
SAMARANI, Prof. Franco. Direttore della Stazione di Batteriologia Agraria. Crema (Cremona).
TOBLER, Dr. Oscar. Agnano Pisano.

Japan.

ADACHI Dr. Agr. Masashi Institute of Agricultural chemistry, Hokkaido Imperial University. Sapporo.
HUDISE, Siza. The Kagoshima Imperial College of Agriculture. Kagoshima.
IMAI, Dr. M. Division of Soils, Imperial agric. Experimental Station. Nishingahara. Tokyo.
KIDA, Prof. Y. Imperial College of Agriculture and Forestry. Miyazaki.
MASASHI, Dr Agr. Adachi, Institut of Agricultural Chemistry, Hokkaido Imperial University Sapporo.
MIYAKE, Prof. Agr. Koji. College of Agriculture, Hokkaido Imperial University. Sapporo.
SEKI, Prof. Dr. Toyotaro. Division of Soils, Imperial Agricultural Experimental Station. Nishigahara. Tokyo.
TAKAISHI, Dr. H. Institute for Training of Teachers of Agriculture. Agricultural College. Komaba. Tokyo.
TAMACHI, Dr. Ishio. College of Agriculture. Hokkaido Imperial University. Sapporo.

Latvia.

PREY, Fräulein Dr. L. Ritterstrasse 53. W. 6. Riga.
WITYN, Johann. Marienstrasse 64. W. 15. Riga.

Lithuania.

Geoloijos Kabinetas Lietuvos Universitetas. (Directeur Prof. Dr. G. L. SMIT SIBINGA). Kaunas.

Norway.

Bibliothek der Landwirtschaftlichen Hochschule. sl. pr. Oslo. Ås.
Bibliothek der Landwirtschaftlichen Hochschule Norwegens. Ås.
Det Kongelige Fredriks Universitet Museum. Adresse " Universitetes Kasserer " Oslo.
Geologische Landesanstalt Norwegens. Kronprinsens gatan. Oslo.
Norges Statsbaners Hovedstyre, Geolog Rosenlund. Jernbanetorvet 8 - 9. Oslo.
BJÖRLYKKE, Prof. Dr. K. O. Ås.

FJELSTAD, Anders, Councillor. Ring.
GAARDER Dr. TORBJOM. Laboratoriums-Vorsteher. Biochemisk-Laboratorium, Bergens Museum. Bergen.
GLØMME, Hans. Dozent, Bodenlaboratorium der Landw. Hochschule Norwegens. Ås.
GOLDSCHMIDT, Prof. Dr. V. M. Geologisches Museum. Universitets min. Institut. Trondjemsveien 23. Oslo.
HAGEM, Prof. Dr. Oscar. Botanisches Laboratorium. Bergen.
HERSAUG, Sekretär O. Det kgl. selskap for Norges vel. Bøndernes hus. Oslo.
HOLTEDAHL, Prof.Dr. Olof, Universitetets geologische-paleontologiske institut. Tøien. Oslo.
HOLTSMARK, Staatsrat B. Bygdo pr. Oslo.
KOLDERUP, Direktør C. F. Bergens Museum. Bergen.
LINDEMAN, Docent Johs. Ås sl. pr. Oslo.
SCHETELIG, Prof. Jacob Geologisches Museum. Oslo.
TRAEN, Docent A. R. Ås sl. pr. Oslo.
WOGT Prof. Dr. J. H L. Norges tekniske høiskoles geologiske institut. Trondhjem.

Palestine.

MENCHIKOWSKY, Dr. Felix. Agricultural Experimental Station. Tel Aviv.
RACZKOWSKI, Henry Agricultural Chemist, Dept. of Agriculture. Haifa. Mount Carmel
REIFENBERG, Adolf. Hebrew University, Institute for Chemistry. Jerusalem.
WINNIK, Ir. Meir. Ingénieur-chimiste. Directeur des laboratoires et des Champs d'Espérience. Mikveh-Israel près Jaffa.

Holland.

Bestuur Waterschap Vollenhove. Prov. Overijssel. Vollenhove.
Directie van het Landbouwkundig bureau van het Kali-Syndikat (den Herr H. Lindeman). Boothstraat 13. Postbus 63. Utrecht.
Hoogheemraadschap van Rijnland. Leiden.
Ingenieursbureau v-h J. van Hasselt en de Koning. van Berchenstraat 23. Nijmegen.
Institut géologique de l'Université d'Agriculture. (Directeur: Prof. J. van BAREN). Wageningen.
N. V. Kunstmesthandel v-h HULSHOF en Co. Maliebaan 52. Utrecht.
Rijksboschbouwproefstation. Directeur: E. HESSELINK. Rijksstraatweg 3. Wageningen.
Rijks Geologische Dienst. (Directeur Dr. P. TESCH). Spaarne 17. Haarlem.
R K. Nederlandsche Boeren-en Tuindersbond. 113 Juliana van Stolberglaan. s' Gravenhage.
Staatsboschbedrijf. Museumlaan 2. Utrecht.
BIJL, Ir. J. G. Ingenieur van den Haarlemmermeerpolder. Haarlemmermeer. Hoofddorp.
ENGELHARDT, Ir. J. H. Rijkslandbouwconsulent. Noorderstationsstraat 74 A. Groningen.

GERRETSEN, Dr. F. C. Directeur van Het Rijkslandbouwproefstation. Afdeeling Bacteriologie. Eemskanaal Z. Z. 1. Groningen.
HISSINK, Dr. D. J. Director Agricultural Experimental Station, Section for Soil Science (Pedology). Herman Colleniusstraat 25. Groningen.
HUDIG, J. Directeur van de Afdeeling voor de Cultuur op zand- en veen-gronden van het Rijkslandbouwproefstation. Groningen.
LIGTENBERG, Ir. J. F. Zeestraat 102. s' Gravenhage.
PANHUYS, Jhr. Ir. C. E. W. van. Carel van Bylandtlaan 3. s' Gravenhage.
SACK, Dr. J. Scheikundige aan de vierde afdeeling van het Rijkslandbouwproefstation. H. W. Mesdagstraat 58a. Groningen.
SPEK, Dr. Jac. van der. Scheikundige Rijkslandbouwproefstation, Afd. v. bodemkundig onderzoek. Herman Colleniusstraat 25 Groningen.
ZIJISTRA, Dr. K. Directeur van de plantkundige afdeeling van het Rijkslandbouwproefstation te Groningen. Eemskanaal Z. Z 1. Groningen.

Dutch Indies.

Algemeen Proefstation der A. V. R. O. S Sumatra's Oostkust. Medan.
Algemeen Proefstation voor Thee. (Directeur Dr BERNARD). Buitenzorg Java.
Deli - Proefstation Sumatra's Oostkust Medan.
Gouvernements Kinsproefstation, Tjinjiroean Pengalengan bij Bandoeng.
Laboratorium voor Bodemkundig onderzoek van het Algemeen Proefstation voor den Landbouw Buitenzorg Java
Laboratorium voor Materiaal - onderzoek, Technische Hoogeschool. Bandoeng. Java.
Proefstation Besoeki (Directeur Dr. ARISZ. Besoeki. Java.
Proefstation Malang. (Directeur Dr. ULTEE) Malang Java.
Proefstation Midden Java. Salatiga. Java.
Proefstation voor de Javasuiker - Industrie Pasoeroean. Java.
Proefstation voor het Boschwezen. Buitenzorg. Java.
Redactie van de Indische Culturen Soekaboemi.
Proefstation voor Vorstenlanden Tabak Klatten. Java.
Rubberproefstation West Java. (Directeur Dr BERNARD). Buitenzorg. Java.
Wetenschappelijke dienst der R. C. M. A. Galang, S. O. K.
Beumée - NIEUWLAND, Nevr Buitenzorg. Java.
BOSCH, A. D. H. Suikerfabriek "Pangka". Tegal. Java.
BOSSCHA, K. A. R. Theeonderneming. Malabar.
DEUSS, Dr. J. J. B. Scheikundige aan het Theeproefstation. Buitenzorg. Java.
HARREVELD, Dr. Ph. van. Directeur van het Proefstation voor de Javasuikerindustrie. Pasoeroean. Java.
HARREVELD - LAKO, C. H. van. Pasoeroean. Java.
HOLTMAN, P. W. Chef proeftuinen der Handelsvereeniging Amsterdam Paree (Karang Dinoja). Kediri. Java.

KAPELLE, I. i. D. W. Chemiker. s. f. "Soemberdadie". Java. Kras SS/O. L.

KEIBOSCH, Dr. Gouv. Kinaproefstation Tjinjiroean. Pengalengan. (bij Bandoeng) Java.

KÖNIGSBERGER, Dr. V. J Cheribon. Java.

SCHEIBENER, Dr. E. E. Assistent bij het laboratorium voor Bodemkundig onderzoek van het Algemeen Proefstation voor den Landbouw. Buitenzorg. Java.

TENGWALL, Dr. T. A. Pasoeroean. Java.

WHITE, Ir. J. Th Hoofd van het Laboratorium voor Bodemkundig onderzoek van het Algemeen Proefstation voor den Landbouw. Buitenzorg. Java.

WULFF, Ir A. Landbouwconsulent. Buitenzorg. Java.

Poland.

Champ d'expériences agricoles à Kóscielec. Poste Kolo, boîte à lettres, skrzynka dolistów No. 22 Kolo.

Division d'Expériencs et de Sciences de la Société Centrale d'Agriculture à Varsovie. Rue Kopernika 30. Varsovie.

Foyer de la Culture Agricole et du Champ d'Expériences à Stary - Brzesc. Stary - Brzesc, poste Stary-Brzesc-Kryàwski.

Institut de Chimie Agricole à l'Ecole Centrale d'Economie Rurale. (Dir. Prof. J. MIKULOWSKI - POMORSKI). Rue Miodowa 23. Varsovie.

Institut der Agrikulturchemie und Bodenkunde an der Polytechnischen Hochschule, Vorstand: Prof. Dr. J ZOLCINSKI bei Lwow. Dublany.

Institut fur Bodenkunde der Universitat Posen. (Instytut Glcboznawezy Universitetu y Paznianiu) (Director: Prof. Dr. F. TERLIKOWSKY). Maxowiecka 42. Poznán.

Landwirtschaftliche Versuchsanstalt. Post Lomza skr. 32 Kisielnics.

Section (Pédologique) de la Science du Sol du Musée de l'Industrie et de l'Agriculture. 66, rue Krakowskie-Przedmiescie. Varsovie.

Stacja Dóswiadczzalna Pomorskiej Izby Polniczei (Station Agricole de la Chambre Agricole de Pomérania) Szopena 22. Torun. (Thoru).

DABROWO, Antoni. Agronome du district Stonim Voyvodie: Nowogródek, poste Stonim; Wydzial powiatowy.

DMOCHOWSKI, Dr. Roman, Rue Bagatela 12a m. 14 Varsovie.

GABRIEL, Dr. Jerry. Czernierwice. Olganowo, District Wloclawek.

GURSKI, Prof. Janusz Henryk. Professeur de la Culture des Plantes. Dublany près Lwów.

GYBULSKI, Dr. Benjamin. Directeur du Foyer de la Culture Agricole et du Champ d'aspériences. Kielce, poste Skalbmierz, Sielec.

KOMAR, Dr. Maksymiljan. Directeur du Foyer de la Culture Agricole et du Champ d'expériences à Opatówiec. Opatówiec, poste Starozreby, District Plock.

MIECZYNSKI, Dr. T. Institut Pédologique. Pulawy.

MIKLASEWSKI, Dr. Slaw. Rue Szopena 61. Varsovie.

PATASINSKI, Romuald. Directeur de la Station Agricole d'expériences à Kutno. Kutno.

SIKORSKI, Prof. Ing. Tadeusz. Professeur de la chaire du Génie Agricole à l'Université de Cracovie. Rue Studencka 4. Kraków (Cracovia).
SKOTNICKI, Prof. Inz. Czeslaw. Recteur de la Politechnique de Varsovie. Varsovie.
STARZYNSKI, Prof. Dr. Zygmunt. Pedologisches Institut der Jagiellowschen Universität. Kraków.
SZPUNAR, Tomasz. Directeur du Champ d'expériences à Blonic, poste Leczyca, voyvodie Lodz.
SZTURM, Jósef. Directer du Foyer de la Culture Agricole et du Champ d'expériences à Poswietne. Ptonsk. Poswietne.
TERLIKOWSKI, Prof Dr. F. Mazowiecka 42. Poznán.
TOMASCHEWSKI, Dr. J. Institut Pédologique. Pulawy.
TREPKA, Franciszek. Directeur du Foyer de la Culture Agricole et du Champ d'expériences à Stary-Brzese. Stary-Brzese. Kryàwski-Stary-Brzese.
WLODEK, Prof. Jean de. U. J. Aleja Miskiewicza 17. Kraców.
ZIEMIECKA, Mme Dr. Jadwiga. Marszalkowska 73. Varsovie.
ZÓLCINSKI, Prof. Dr. Jan. Polytechnische Hochschule. Dublany bei Lwów.

Portugal.

3ª Secção da Estação Agraria Naciónal. Lisboa-Belem.

Rumania.

Institut Geologic al României. Soseaua Kisileff 2. Bucuresti.
Laboratoire de Géologie, Minéralogie et Agrogéologie de la "Scoala Superioara de Agricultura Herastra" (Directeur: Prof. Dr P. ENCOULESCOU). Bucuresti.
Naturwissenschaftliches Museum von Kischineff. (Mueul National din Chisinau) Vorsteher: Dr. N. FLOROV. Chisinau. Basarabia.
ENCOULESCOU, Dr. P. Géologue chef à l'Institut géologique de Roumanie, Kiselef 2. Bucuresti.
KEREKES, Dr. Stephan. Chemiker in der Zuckerfabrik. Fabrica de Sahar. Targu-Mares.
PROTOPOPESCU PAKE, Prof. Em. I. Prof. supl. à l'Ecole Polytechnique Géologique, Chef à l'Institut Géologique. Soseaua Kisileff 2. Bucuresti.
SAIDEL, Dr. Teodor. Chimiste chef à l'Institute Géologique de Roumanie. Section Agrogéologique. Kiselef 2. Bucuresti.

Serb-Croat-Slovene State.

Bodenkundliches Institut der land- und forstwirtschaftlichen Fakultät der Universität. Mazuranocev trg 24. Zagreb.
SEIWERTH, Prof. Dr. Ing. Adolf. Vorstand des Bodenkundlichen Institutes der Universität. Mazuranim trg 24. Zagreb.

Russia.

Institut der Bodenkunde und Geobotanik der Mittelasiatischen Staatsuniversität. Obuchowsky 14. Taschkent.

Institut Selkohesiajstwennyeh Melioratzyi, Selsko-Hosiajstwennaja Academia. Direktor : Prof. KOSTIAKOW' y Petrowsko - Rasumowskoje. Moskau.
Laboratorium für Agrikulturchemie und Bodenkunde bei der Kazan'schen Universität. Kazan.
Landwirtschaftliches Institut. (Rektor : Prof. A. HAYGORODOW). Weissrussland. Kreisbezirk Orscha U. S. S. R. Gory-Gorki.
Moskau - Komitee der Pedologie. Smolensky, Bulw, 57. Moskau.
ABOLIN, R. I. Institut der Bodenkunde und Geobotanik. Obuchowsky, 14. Taschkent.
AFANASSIEFF, Prof. J. N. Landwirtschaftliches Institut. Weissrussland. Russland.
ANTONOFF, Frau M A Pedologin der Pedologischen Section des Staats-Institutes der Versuchs-Agronomie. Zagorodny prospect, 28, w. 40. Leningrad.
ARCHANGELSKY, Frau N A Wasily-Insel, 5 Linie, 46, w 25 Leningrad.
BESSONOFF, Prof A. I. Prof der Pedologie des Samara-Hochinstitutes der Landwirtschaft. Vosnesenskaja 130. Samara.
DIMO, Prof N A Institut der Bodenkunde und Geobotanik. Obuchoffstrasse 14. Taschkent
DOMRATSCHEFF, Frau E A Str. der Friede, 28, w. 18. Leningrad.
FILATOFF, Prof. M. M. Universitat, Institut der Landwirtschaft. Mochowaya, 1. Moskau.
GEDROIZ, Prof K. Forstinstitut Leningrad.
GLINKA, Prof. K D. Landwirtschaftliches Institut. Tschajkowsky str., 1. Leningrad.
GORSCHENIN, Prof. K. P. Sibirien-Landwirtschaftliche Akademie, Setkion Bodenkunde. Omsk.
HEMMERLING, Prof. W. W. Granatny pereulok, 14. Moskau.
ILLYIN, R. S. Komitee der Bodenkunde. Smolensky bulw., 57. Moskau.
IMSCHENETZKY, I Z Pedologe des Moskau-Komitee der Pedologie. Spasskystrasse, Krasnoprudny pereulok 3, w. 8. Moskau.
JARILOFF, Prof A A Wosdwijenka, 5 Gosplan. Moskau.
KALUGIN, N A Leiter des Samara-Hochinstituts der Landwirtschaft. Ilyinskaya-strasse 113 Samara.
KASSATKIN, Prof Minsk.
KATZINSKY, N A. Gehulfe des Verwalters der Moskauer Versuchsstation. Moskau-Kiewo-Woroneg Eisenbahn. Station : Sobakino.
KIRSSANOFF, Prof. A. Director des Weissrussischen Wissenschaftlichen Instituts für Moorkunde. Minsk.
KLAWDIENSKO, K. M. Institut der Bodenkunde und Geobotanik. Obuchoffstrasse, 14 Taschkent
KRASSÜCK, Prof. A. A Vasily-Insel, 11 Linie, 42, w. 11. Leningrad.
KRAWKOFF, Prof. S. P. Vasily-Insel, 16 Linie, 29. Leningrad.
KROKOS, Prof. W. J. Handelsstrasse, 5, w. 9. Odessa.
KURBATOW, Prof. N. I. Tashkent University. Tashkent.
KUSENOFF, Frau O. J. Geographisches Institut. Mojka, 122. Leningrad.
KUSMIN, M. S. Versuchsstation. Saratow.
KUTLER, Frau E. N. Borissoglebsky per, 6, w 6. Moskau.

LEBEDEFF, Prof. A. F. Prof. der Rostow Universität und Chef der hydrologischen Abteilung. Rostowo-Nachtischewansche Landwirtschaftliche Gebiet-Versuchsstation. Rostov.

LEBEDJANZEFF, Prof. A. N. Versuchsstation. Tula-gouw. Schatilowo.

LEWITZKY, Prof. A. P. Granatny per., 10, w 2. Moskau.

MURAWLJANSKY, S. M. Landwirtschaftliches Institut. Charkow. Kleinrussland.

NEGODNOFF, J. K. Landwirtschaftliche Versuchsstation. Taschkent. Turkestan.

NEUSTRUEV. Prof. Dr Serge. Professor für Geographie des Bodens an der Geographischen Hochschule (beim Geogr Institut). Mytninskaya naberegnaya 9, log 2. Leningrad.

NICKITIN, W. W. Ural. Landwirtschaftliche Versuchsstation. Pern.

NOJIN, L. L. Smolensky bul., 51, w. 18. Moskau.

OPPOKOFF, Prof. E. W. Prof der Hydrologie am Kiew-Polytechnischen Institut. Kiew. Kleinrussland.

ORLOFF, M. A. Institut der Bodenkunde und Geobotanik, Obuschoffstrasse, 14. Taschkent.

ORLOFF, S. P Landwirtschaftliche Versuchsstation. Wjata - gouv Kossa.

PANKOFF, Prof A. M. Berg-Landwirtschaftliches Institut. Wladikawkas.

PAWLOFF, E. F. Berg - Landwirtschaftliches Institut. Bodenkunde Sektion. Wladikawkas.

POLYNOV, Prof. Dr. Boris. Professor fur Geologie und Bodenkunde an der Polytechnischen Hochschule. Spasskaja, 2. log. 5. Leningrad.

PORFIRIEFF, N. D. Neu-Komissariatskaja 4, w. 5 Kazan.

PRASSOLOFF, Prof. L J. Vasil - Ostr 12 Linie m. 33, log. 18. Leningrad.

PROCHOROFF, Prof. N. J. Geographisches Institut. Nojka, 122. Leningrad.

REMISOFF, N. A Tschernischewskystrasse 6 Charkow. Kleinrussland.

ROSOFF, L. P. Alte Strasse 10-15, w. 3. Petrowsky - Rasumowsky. Moskau.

SAITZEFF, N. M. Universität, Institut der Landwirtschaft. Mochowaya, 1. Moskau.

SAWARENSKY, F. P. Leiter der Geologie der I. Moskau-Staatsuniversität. Trubnikowsky pereulok, 26, w. 18. Moskau.

SCHOKALSKY, M.lle Zénaide. Rue Rétchani Pétchatnikof 27. app.19. Leningrad.

SCHMUCK, Prof. A. A. Tabackkultur - Versuchsinstitut. Postkasten 55. Krasnodar.

SCHTSCHEGLOFF, I. L Leiter der Pedologie des Saratow-Landwirtschaftlichen Hochinstituts. Saratow.

SCHULGA, Prof. I. A. Prof. der Pedologie des Don- Hoch- Instituts der Landwirtschaft und der Melioration. Nowotscherkassk.

SERGEEFF, Frau E. J. Excursion-Station, Lachta. Leningrad.

SKWORZOW, G. A. Institut der Bodenkunde und Geobotanik. Obuchowsky, 14. Taschkent.

SKWORZOW, G. A. Institut der Bodenkunde und Geobotanik. Obuchowsky, 14. Taschkent.

SMIRNOFF, J. J. Ural - Landwirtschaftliche Versuchsstation. Perm.

SOCKOLOFF, N. N. Mochowaja str., 5, w. 6. Leningrad.

SOKOLOFF, A. W. Vorsteher des Agrochemischen Laboratoriums der Radomysler Versuchsstation. Irscha. Gouv. Kiew.

SOKOLOWSKY, Prof. A. N. Prof. der Bodenkunde an der Universität. Charkoff.

TICHEEFF, Frau L. W. Str. der rothen Röthe, 54, w. 45. Leningrad.

TISENHAUSEN - KOSTÜCKEWITSCH, Prof. A. W. Prof. der Geologie und der Pedologie der Smolensk-Staatsuniversität. Smolensk.

TROITZKY, E. P. Universitats Institut der Landwirtschaft. Mochowaja, 1. Moskau.

TULAYKOFF, Prof. N. M. Agricultural Experimental Station. Saratow.

TÜLIN, A. F. Staatsuniversitat, Agrarfakultat. Petrowsky-Rasumowsky. Perm.

TUMIN, Prof. G. M. Stein-Steppische Versuchsstation. Talowaja. Woronesch - Gouv.

TURIN, J W Grusinskaja 43, w. 4 Kasan

TURREMNOFF, Prof S J Landwirtschaftliches Institut. Krasnodar.

WARLIGIN, P. D Grosser Tolmatschewsky pereulok 18, w. 9.

WINOKUROFF, W. A. Sibirien - Landwirtschaftliche Akademie. Omsk.

WOSKRESENSKY, M N. Institut der Bodenkunde und Geobotanik. Obuchoffstrasse, 14. Taschkent.

WYSOTZSKY, Prof. Dr G N Professor fur Forstkunde und Waldbau. Tschajkiwskastrasse 4, T. 38 Charkiv (Ukraine).

ZACHAROFF, Prof S A Prof. der Pedologie des Kuban-Landwirtschaftlichen Hochinstitutes. Gumbskayastrasse 52 U. S. S. R. Tiflis.

ZAITZEFF, N. M., Universitat. Institut der Landwirtschaft Mochowaya 1, Moskau.

ZAWARITZKY, W. N. Trubnikowsky per. 19, w 32. Moskau.

Sweden.

Skogshögskolans bibliothek. Experimtentalfältet.

Kgl. Lantgruksakademien. Stockholm.

Kgl. Vetenskapsakademien Stockholm.

Lunds universitets geologiskmineralogiska institution. Lund.

Statens Kemiska Station i Örebro. (Direktor: Dr. Gottfrid Nannes). Örebro.

Statens skogsfursöksanstalts naturvetenskapliga avdelning. Experimentalfältet.

Svenska Mosskulturföreningen. (Direktor: Hugo OSVALD). Jönköping.

Sveriges geologiska undersökning. Stockholm, 50.

Växtbiologiska institutionen. Uppsala.

ANDERSSON, Prof. Dr. fil. Gunnar. Djursholm.

ARRHENIUS, Dr. fil. Olof. Gamla Haga. Stockholm.

ASSARSON, Lic. fil. Gunnar. Sveriges geologiska undersökning. Stockholm, 50.

BACKLUND, Prof. Helge. Uppsala.

BARTHEL, Prof. Christen. Experimentalfältet.

ECKERMANN, Dr. fil. Harry von, Bergsingeniör. Ljusne.
ECKSTRÖM, Lic. fil. Gunnar. Sveriges geologiska undersökning. Stockholm, 50.
FEILITZEN, Prof. Dr. fil. Hjalmas von. Direktor der Ackerbauabteilung. Schwedische Landw. Central-Versuchsanstalt bei Stockholm. Experimentalfältet.
FLODKVIST, Herman. Jordbrukskonsulent. Örebro.
GAVELIN, Dr. fil. Axel. Overdirektör. Karlavägen, 28. IV. Stockholm.
GIÖBEL, Cännar, c/o Dr. C. BARTHEL. Experimtalfältet.
HALDEN, Dr. fil. Bertil. Lektor. Experimentalfältet.
HEDLUND, Prof. Dr. fil. Teodor. Åkarp. Alnarp.
HESSELMANN, Prof. Dr. fil. Henrik. Djursholm.
JOHANSSON, Dr. fil. Simon Staatsgeolog. Stockholm, 50.
LUNDBLAD, Ingeniör Karl. Utanbygatan, 12. Västeras.
MALMSTRÖM, Dr. fil. Carl. Experimentalfältet.
NANNES, Dr. fil Gottfrid. Director Kemiska Stationen. Örebro.
ODÉN, Prof. Sven. Experimtalfältet.
OHLSSON, Prof. Dr. fil. Erik. Alnarp. Åkarp.
OSWALD, Dr. fil. Hugo. Dozent, Svenska Mooskulturföreningen. Jönköping.
ROMELL, Dr. fil. Lars Gunnar, Dozent. Sveavägen 52. Djursholm.
TAMM, Dr. fil. Olof. Dozent. Statens Skogsförsök-Anstalt. Experimentalfältet.
TORSTENSSON, Dr. G. Haga Gard. Knifesta.
VESTERBERG, Prof. Dr. fil K. A. Lidingön. Herserud bei Stockholm.

Switzerland.

Schweizerische Agrikulturchemische Anstalt. Bern. Liebefeld.
Schweizerische Landwirtschaftliche Versuchsanstalt. Oerlikon. Zürich.
GESSNER, Dr. Hermann. Buchs bei Aarau.
GIRSBERGER, Oberst J. Kultur-Oberingenieur. Kaspar Escherhaus. Zürich, I.
SCHERF, Ing. Dr. Emil. Ingenieurchemiker, Eidgen. Technische Hochschule, Agrikulturchemisches Laboratorium. Zürich.
VOLKART, Prof. Dr. A. Schweizerische Landwirtschaftliche Versuchsanstalt. Oerlikon. Zürich.
WIEGNER, Prof. Dr. Georg. Adlisbergstrasse 82, (Universitätsstr. 2). Zürich.

Surinam.

DIJK, Ir. J. W. van. Scheikundige aan het Landbouwproefstation. Paramaribo.

Czechoslovakia.

Bureau Pédologique du Conseil d'Agriculture. Praha.
Zemedelska-technicky, referát expositúry v ministersva Gemedelsva. Stefanowiceva 41.. Bratislava.

Institut agropédologique de l'Etat. Karlovo nám. 3. Praha, II.
Institut de l'Etat pour les recherches agronomiques. Maturskova 434. Bratislava.
Institut des recherches agricoles du pays morave. Květná 19. Brno.
Pedologische Abteilung des technischen Bureaus des Landesschulrates fur Böhmen. (Vorsteher: Dr. R. JANOTA). Jungmannova, 32. Praha.
Pedologische Kanzel der tschech. technischen Hochschule. (Vorsteher: Prof. Ing. JOSEF KOPECKY) Karlovo nám. 3. Praha II.
Státne vyskumné ústavy zemedelski (Staatliche Landwirtschaftliche Versuchsstation). Komenského ul. 22. Kosice.
DOERELL, Dr. Ing. E. G. Dozent an der Böhmischen Technischen Hochschule. Praha.
GÖSSL, Ing. Vladimir. Assistent der pedologischen Kanzel an der technischen Hochschule Karlovo nám 3 Praha, II
HRDINA, Ing. J. Adjunkt der Landesversuchsanstalt Kvetná 19. Brno.
HEINITZ, Fachrat, Dr Bohuslav. Vorstand der agrikulturchemischen Versuchsstation des L. K. R Jáma 8, III st. Praha, II.
JANOTA, Dr Ing. Rudolf. Baurat - Pedologe des Landeskulturrates. Jungmannova tr. 32 Praha, II
KOPECKÝ, Prof Ing Jozef Institut agropédologique de l'Etat. Karlovo nam. 3. Praha, II.
KYAS, Ing. O. Directeur de l'Institut Pédologique. Kvetná 19. Brno.
KYNTERA, Inz Frant. Vorstand der Agropedolog. Anstalt Matuskova 934. Bratislava
NOVÁK, Dr. V Chef de l'Institut Pédologique. Kvetna, 19. Brno.
OTOTZKY, Prof P. Bubenec, Buckowa, 597. Praha.
SIMEK, Ing. J. Assistant de l'Institut Pédologique. Kvetna 19. Brno.
SMOLÍK, Dr. Lad. Inspecteur de l'Institut Pédologique. Kvetná 19. Brno.
SOUCEK, Ing Dr. Jaroslav. Adjunkt des Forschungsinstituts der csl. Republik. Na Vorechovce. Praha. Stresovice.
SPIRHANZL, Ing. Jaroslav. Institut agropédologique de l'Etat. Karlovo nám. 3. Praha, II.
STOKLASA, Prof. Dr Julius. Professor an der Böhmischen Technischen Hochschule und Direktor der Staatlichen Versuchsstation. Kral. Vinohrady. Praha.
THOMA, Prof. Dr. Emanuel. Professor an der tschech, technischen Hochschule. Kalovo nám 3. Praha, II.
TRNKA, Prof. Dr. Rudolf. Augustinergasse 17. Brno.
ULRICH, R. N. Dr. F. Asistent Karlovy University. Albertov 6. Praha, II.
VALIECK, Ing. J. Inspecteur de l'Institut biochimique. Kvetná 19. Brno.
ZAVADIL, Prof. Dr. Jan Vysoka Skola Technika. Brno.

Uruguay.

ARREGUI, A. Aguirre. Ingeniero Agrónomo y Químico Farmaceutico. Calle Ibicuy 1299. Montevideo.
SCHRÖDER, Dr. John. Sucursal 27. Sayago, S. A.

PROCEEDINGS OF THE INTERNATIONAL SEED TESTING ASSOCIATION

Papers.

SEED INJURY FROM FUNGI AND INSECTS.

In seed research not only the germinating power, purity and genuineness are of interest, but an important factor also is the sanitary condition. Sometimes, though the germination power is satisfactory, the seed is still not sufficiently sound and so is not fit to be sown. It may be improved by disinfection, but in some cases there is no remedy and the whole lot has to be rejected for sowing purposes.

As to fungous diseases, two different ways may be distinguished in which these can be transferred by the seed: (1) the seed may be infected by spores (e. g. *Tillctia*), (2) mycelium may have penetrated into the seed.

As to the latter, the sanitary condition may be easily verified after the seeds have been in a moist atmosphere for a few days as this permits any existing fungi or bacteria to develop more readily.

Generally the presence of fungous diseases may be easily diagnosed by examining the germinating beds. But the seeds in these beds are somewhat close together, so that there is danger of contact infection. For this reason it is preferable to use open zinc trays (26 cm. × 10.5 cm.), covering the perforated bottom of these trays with moist filter paper and laying a similar cover over the whole. The number of seeds for the test is so limited, that contact infection may in this way be avoided.

Should the seeds not happen to be in good condition owing to their vitality being damaged from some cause, they are less immune against saprophytic fungi. The presence of such fungi, though not itself causing disease, indicates an inferior soundness of the seed. Such saprophytic fungi may be different species of the following genera: — *Penicillium, Aspergillus, Rhizopus, Mucor, Cephalothecium, Oedocephalum, Stysanus, Acrostalagmus, Alternaria, Chaetomium,* and others.

Fungi belonging to the pathogenic group, however, are of more importance and a short summary of these is given as follows.

Peas are often infected by *Ascochyta Pisi*. When the germinating power is ascertained, this fungus is as a rule easily recognized, and the percentage of attack may also be determined On the dry seeds the infection is often indicated by yellowish spots, which, however, cannot always be determined with certainity, and so in inspecting the seed beds, the infection may prove to be more severe than seemed probable from the infection of the dry seeds.

The severity of the infection varies in different years. The past season (1924) in this respect has been a very bad one in Holland, as may be seen from the following table

Season	Percentage of Ascochyta attack										
	0 (1)	10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100
	%	%	%	%	%	%	%	%	%	%	%
1920–21	11	40	25	10	7	4	3	0	0	0	0
1921–22	25	42	15	8	2	1	6	0	0	0	0
1922–23	25	6	5	2	0	1	0	0	0	0	0
1923–24	34	41	12	10	0	1	1	0	0	0	0
1924–25	8	35	10	15	8	8	3	3	2	1	0

(1) Percentage of samples examined at Wageningen

With regard to this fungous infection it seems desirable to fix a limit above which no seed should be considered fit for sowing. Not only the percentage of infected seeds is of interest, but also the severity of attack of each individual seed If the percentage of infection be a high one, then the degree of individual infection is also sure to be very severe, that is to say most of the seeds will be as a rule badly infected, the cotyledons being penetrated to a marked degree by the fungus. From such a diseased seed there will develop, if anything, a very weak seedling, which is likely to perish at an early stage. If the diseased spot be not too large, the plant may grow, but it may then become a source of infection to adjacent plants, if the weather be favourable for the further development of the fungus. The consequence of serious infection is thus twofold (1) the seedling is abnormal in appearance, (2) diseased plants are produced.

Other fungous infections apparent on peas, are caused by *Macrosporium* sp., *Fusarium* spp., and *Botrytis cinerea*. The exist-

ence of these three fungi may also be determined in relation to germinating power.

In addition to the above, peas may be damaged by *Bruchus pisi* or by *Grapholitha nebritana.* As regards the first, it should be mentioned that in the samples tested at Wageningen, a weevil was rarely present in the infected peas, and as a rule there was only the round hole left by the insect. One series of samples, however, sent for testing this season, appeared seriously attacked, and in this case most of the infected seeds still contained the insect in a more or less developed stage. This series had been imported from another country, with different climatic conditions.

Beans may be infected by *Colletotrichum* (*Gloeosporium*) *Lindemuthianum.* On moist seeds in the seed-bed, the spores are formed freely on bright colored spots with a characteristic dark border. On dry seeds of bright colored species these spots are easily recognised, although less distinct on the brown colored types

The *Macrosporium* infection is much more common on beans than on peas. The infected dry seeds show a small pink spot just underneath the micropyle. During germination, the spot enlarges considerably and becomes purple with a yellow margin. A greyish mycelium develops with multi-cellular spores. The perithecial stage, *Pleospora*, belonging to this species, though as a rule immature, is also very frequently formed. This infection is often dealt with by various disinfectants, as the fungus is rather superficial. In this way, if the attack is not too serious, normal plants may be produced. The damage may be serious at the early stages of plant growth, but can be checked at the first stage. If the plant outgrows this dangerous period it will not show any symptoms of attack, though the spores may be found later, dispersed on leaves and pods, apparently not causing much harm. It is therefore only if the first stage of development be neglected, that the fungus may become disastrous

In Holland, 1923 was a very bad season as regards quality of beans. During harvest time, the weather had been decidedly moist, and consequently the seeds were exposed to unfavourable conditions before being harvested. No specific disease occurred, but there was a large increase of various saprophytic fungi and bacteria. In many cases, disinfection was effective especially against fungous attacks, compared with bacteria infection.

In connection with disinfection of seeds in general, the follow-

ing observation may be made. Disinfection may favour the health of the seeds before they are brought to the seed beds. It is not, however, advisable, if the germinating power has to be determined, as this mechanical process is liable to alter the condition of the seed. The determination of the germinating power of disinfected seeds may, nevertheless, be a distinct advantage to the sender of sample grains of cereals, beans, beet seeds, etc., as compared with untreated seeds. In this way he is able to get a good idea as to the state of the seeds and at the same time information respecting any possible improvement. In Wageningen, therefore, such tests are made regularly with disinfected seeds.

Beans may also be at acked by weevils. Great losses may be caused by *Bruchus obtectus*. As contrasted with *Bruchus pisi*, this species lays eggs also on the mature seeds, into which the larva bores. In this way the spread of infection in the stored seeds may be accentuated. This form of infection is, however, exceptional in our country.

Also in field beans (*Vicia Faba*), if attacked by *Bruchus* spp., the weevil is often to be found in the seeds. The two species found in this case are: *Bruchus atomarius* (*granarius*) and *B. rufimanus*. Sometimes the weevil appears to be attacked by ichneumons, and a fly instead of a weevil is seen in the hole

Cereals are more especially attacked by *Fusarium* sp. This may readily be detected in the seed-beds. In Holland, particularly oats and wheat are sometimes liable to severe infection. The years 1919 and 1920 were bad *Fusarium* years in this country, but since then the infection has not returned to such an extent. Mycelium and spores, which differ with varius species, develop freely in the humid germinating seed beds. For example, *Fusarium culmorum* is characterized by the chocolate-coloured spores; *F. herbarum* by the salmon colour; *Gibberella Saubinetii* by the purplish brown mycelium and the tendency to form dark bluish perithecia. To be quite sure of the species, a microscopical examination is necessary. In the bad *Fusarium* years, the *G. Saubinetti* was the most widely spread: and secondly *F. culmorum*. In addition to these the following infections may be mentioned: *Claviceps purpurea*, the sclerotia of which are frequently found to be mixed with the grain; fritfly, especially in oats; *Tilletia Tritici* and *T. foetans* on wheat. An indication of this form of infection is firstly the smutted grain and secondly the loose spores. These may best be detected

by soaking about 100 grains in water. The water is then drained off and in order to get a more condensed spore emulsion, the water may be partly evaporated until only a few drops are left, or else a centrifuge may be used followed by microscopical examination, to detect whether the grain is infected by *Tilletia.*

Still other forms of infection may be mentioned, such as *Colletotrichum linicolum* and *Botrytis* sp. on flax seed. The percentage of infection may also be determined Zinc trays, as described earlier, with moist filter paper at the bottom, may be used also in this case. It has been found practicable to divide the tray into four partitions by means of three glass dividers on which a covering glass plate rests. In this way, the space within is kept moist. About six days after the seeds have been placed in the germinating beds, the *Botrytis* colonies are counted. Infections caused by *Colletotrichum* may be treated in the same way. Treatment with Uspulun dry disinfectant or with Germisan have proved very effective in the control of *Botrytis* infection. These dry disinfectants are easily handled as compared with solutions, which are of course unfit for disinfection of flax seeds.

On beet seeds infection of *Phoma Betae* is verry common and samples which are wholly free from this fungus are scarce. An examination of these seeds at the time of determination of the germinative power, by means of a binocular microscope, has shown the occurrence of *Phoma* pycnidia on the seeds or on the root, and thus it is possible to state the degree of the infection as a percentage. Treatment of the seed with a 50 % Germisan solution for two hours, checks the infection to a considerable extent.

Seeds of prasley and celery may be infected by *Septoria Petroselini* and by *S. Petroselini* var. *Apii ;* the pycnidia of these fungi may also be detected by means of a binocular microscope.

Sometimes tree seeds may be damaged by insect pests, as for example in certain samples sent for testing to Wageningen : —

Pseudotsuga Douglasii by *Megastigmus spermotrophus ;*
Abies pectinata by *Megastigmus strobilobius ;*
Rosa multiflora by *Megastigmus* sp.
Betula alba by *Oligotrophus betulae.*

The above account, though far from being complete, will show the need for a more uniform method of research in these matters.

L. C. DOYER,
Seed Testing Station, Wageningen.

THE DISTINCTION BETWEEN SEEDS OF ITALIAN RYE-GRASS AND PERENNIAL RYE-GRASS AND BETWEEN SEEDS OF RYE-GRASS AND MEADOW FESCUE

Foreword.

Perennial Rye-grass and Italian Rye-grass are two of the most important and most commonly cultivated grasses in Denmark, about 1 600 000 kg. and 800 000 kg. seed of these species respectively being used every year. This represents about 20 and 10 per cent. respectively of our entire consumption of grass and clover seed. These two species are, as is known, somewhat different from each other in respect of permanence, hardiness and adaptability to the soil. Their seeds bear a strong resemblance to each other; those of Italian Rye-grass are certainly partly furnished with awns, but threshed and cleaned lots often contain 50-75 per cent. awnless seeds, the well known and high-yielding Danish strain Tystofte No. 152 especially, containing many such seeds. As is known, seeds of Perennial Rye-grass have generally no awns or, occasionally, very small awns So far, it has proved impossible to distinguish with certainty between seeds of Perennial Rye-grass and awnless seeds of Italian Rye-grass. Various authors have mentioned that the shape of the teeth on the inner pales are sufficiently characteristic to identify the two Rye-grass species; the difference in this respect, however, frequently does not hold good, so it is inadequate for differentiating with certainty between the two seed species.

At my request, Herr E. HELLBO (agricultural scientist) being employed as scientific assistant at the Danish State Seed Testing Station, has made observations with a view to determining realiable botanical criteria for the species in question.

As Herr HELLBO's researches having reached a stage where it is considered that positive results have been obtained, we have decided, in view of the considerable number of tests made, to record these results; reports on subsequent researches will be published in due course.

Some of the assistants at the Danish State Seed Testing Station are now able to make this determination of the identity of Rye-grass, and from 1st October, 1925, we are prepared to de-

termine, by microscopic examination (1) whether a sample consists of Perennial Rye-grass or of Italian Rye-grass (2), if a sample of Perennial Rye-grass contains seed of Italian Rye-grass, and vice-versa, and (3) the percentage of each of these species in any sample.

K. DORPH-PETERSEN,
Director of the Danish State Seed Testing Station

I. *Italian Rye-grass and Perennial Rye-grass.*

In the summer of 1922, while making observations in the control fields of the Danish State Seed Testing Station, I noticed for the first time a distinction between Italian Rye-grass and Perennial Rye-grass in the presence or absence of teeth at the marginal nerves of the outer palea, and since then this distinction has been the object of my observations A provisional account of the results of my investigations is given below.

A short description of those characters of the two species which I have especially examined is given, whereas such differences as refer to the morphology of the seesd, being without interest in this connection, are left out of .consideration.

In this report the term " seeds ", as ordinarily used when referring to grasses, denotes the fruit enclosed by the outer and the inner palea

Seeds of Italian Rye-grass (*Lolium italicum* Braun) are generally oval. The outer palea as a rule bears a long awn, but this characteristic is not always present, even in unthreshed lots. *At that portion of the marginal nerves of the outer palea which is marked* b (*Fig.* 14 *a*) *I have, with the undernoted exceptions, always found from one to many teeth, as a rule comparatively large.* Those portions marked *a* and *c* were also in most cases furnished with teeth. The teeth at the nerves of the inner palea are *most frequently* long and comparatively narrow (O. ROSTRUP). The rachilla is narrower and more cylindrical than that of Perennial Rye-grass.

Seeds of Perennial Rye-grass (*Lolium perenne* L.) often have a somewhat rectangular shape. Only in a few cases is the outer palea furnished with a poorly developed awn. I am inclined to believe that the presence of an awn is often due to crossing

in a far-off generation. *On that portion of the two marginal nerves of the outer palea marked* b *in Fig. 2 teeth have not been observed* (except in the under-mentioned peculiar cases), whereas teeth often occur at the portions marked *a* and *c* (especially at the latter). The teeth at the nerves of the inner palea are, compared with those on Italian Rye-grass, *most frequently* short and broad, and the rachilla is broader, more flattened, and more closely pressed to the inner palea than that of Italian Rye-grass (O. ROSTRUP).

In my observations I have left out of consideration whether the seeds were awned or not, as the object was to discover a method of distinguishing between the two species even if the awns were absent or if they had been broken off by the threshing and the cleaning of the seed. Italian Rye-grass after being threshed and cleaned often contains as much as 40 to 75 per cent. awnless seeds

Of the authors, whose works have been at my disposal, only one, viz. E. D. HARTZ ("*Landwirtschaftliche Samenkunde*" 1885), has mentioned in this connection teeth at the outer palea, which he describes as "kurz-borstig gewimpert" (bearing short hairs). It is not clear, however, either in the text or in the illustrations in his book, what he means, and he does not appear to attach any great importance to this condition.

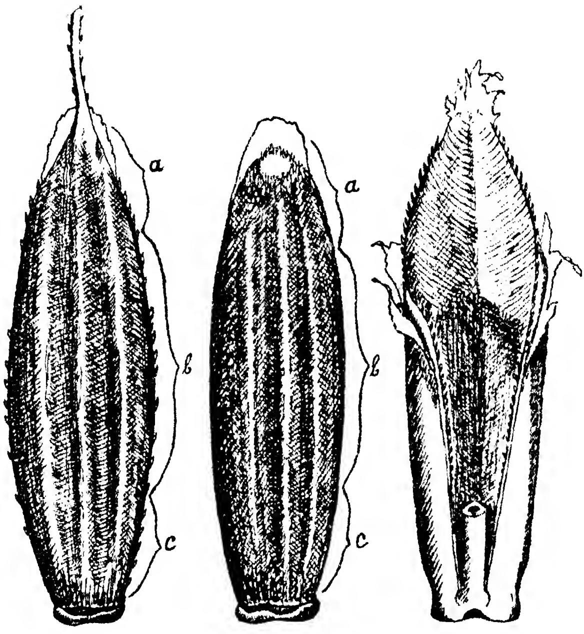
Frequently, when I have found teeth on Perennial Rye-grass at the portion marked *c* (Fig. 14 β), they have been somewhat lengthened and bent. Very occasionally, on the *uppermost* seeds in the spikelets of this species, I have observed teeth on the marginal nerves from the end to the middle of the seed. It has always been possible to recognise these "uppermost seeds" from the others on account of their smaller size and their tendency to taper upwards. These "uppermost seeds" very seldom occur in well-cleaned lots as they are generally poorly developed.

The seeds of Italian Rye-grass — as previously mentioned — are furnished with a variable number of teeth at that portion of the marginal nerves of the outer palea that is marked *b* with the exception, however, of, on an average, 5-6 per cent. of the seeds examined.

The majority of the seeds without teeth, however, have been found to be the *lowest seeds* in the spikelet; these as a rule differ in shape from the seeds above them. Such a "lowest seed" is illustrated in Fig. 14 γ; it is characterized by its flat-topped glumes

and its broad rachilla. An awn is generally absent, and very often the glumes contain no fruit, or only a poorly developed one. The greater portion of such seeds is usually removed during cleaning operations. A test of Italian Rye-grass as to genuineness of species, should therefore be made of the "pure seed" of the sample.

Practically all these "lowest seeds" of Italian Rye-grass as



α β γ

FIG. 14. — α. Italian Rye Grass (*Lolium italicum* Braun).
β. Perennial Rye-Grass (*Lolium perenne*).
γ. Italian Ry-eGrass (*Lolium italicum* Braun).
Lowest seed in spikelet).

well as the few others without teeth on the middle portion of the marginal nerve, had those long teeth on the nerves of the inner palea, which several authors have considered characteristic of the species in question. I shall not enter here into further details with respect to these teeth, which have been somewhat differently described by a number of authors (O. ROSTRUP, A. VOLKART and F. G. STEBLER, S. F. ARMSTRONG, G. LAKON and others). Though the size of the teeth on the inner palea may vary within each of the

two species, yet the charateristic length may be important in determining those seeds of Italian Rye-grass which are not toothed at the middle of the marginal nerves of the outer palea.

WITTMACK, amongst others, mentions that the inner palea of Italian Rye-grass is as long as the outer palea, and that in Perennial Rye-grass the inner palea is shorter than the outer palea, but this rule according to our observations does not appear to hold good in all cases.

Seeds of both species may have teeth on the surface of the outer palea in other places than the marginal nerves. For example, Italian Rye-grass has sometimes (more frequently than Perennial Rye-grass) teeth on the surface between the marginal nerve and the membranous edge of the outer palea. Mention should be made of the fact that in Italian Rye-grass teeth have sometimes been noticed to be present on one of the marginal nerves and absent on the other

A binocular microscope (magnifying either 33 or 45 times) or a lens (magnifying 16 times) has been used in the observations. The teeth mentioned may most easily be seen in transmitted light when the seed is lying with the back upward on a slide under the microscope, provided that the marginal nerves are situated exactly on the edge of the seed. Unfortunately this is not always the case, and, therefore, some seeds must be held with the fingers under the microscope or before the magnifying glass and at the same time turned round.

An account of the results obtained from the observations carried out is given below:

A. *Italian Rye-grass.*

(1) From each of the 13 different plots in the experiment garden of the Danish State Seed Testing Station, sown with samples of Italian Rye-grass, one typical plant was harvested (7 of the Danish strain Tystofte No. 152, 1 described simply as Danish, 3 Irish, 1 Irish-French, and 1 French); 50 kernels from each of these plants were carefully examined. On an average about 11 per cent. of these seeds lacked teeth at the middle portion of the marginal nerves, but nearly all were recognised as "lowest seed" in the spikelet, and, moreover, were furnished with long teeth at the nerves of the inner palea. In the examination of the seeds, their devel-

opment has been left out of consideration, the rather high average percentage of seeds without teeth in this uncleaned material thus being partly due to the fact that even empty glumes (most frequently "lowest seed") have been taken into consideration, and partly to the fact that the seeds at the time of harvesting were over-ripe. Owing to this circumstance some of the seeds had probably fallen off, which resulted in the samples containing a comparatively large number of "lowest seeds" as at it is usually the uppermost seeds in the spikelet that are lost.

(2) Seeds from about 15 plants of the second generation of 14 different families of the Danish strain Tystofte No. 152 have been examined. This particularly good material was kindly placed at our disposal by the manager, P. O. ANDERN, of the experiment farm "Roskildegaarden". 100 seeds from each sample have been examined; 95,8 per cent. had distinct teeth at the middle of the marginal nerves. The 4.2 per cent. seeds without teeth varied in these samples from 0 to 9 per cent.; these seeds, which could in nearly every case be identified as the lowest seeds in the spikelet, had long teeth at the nerves of the inner palea

(3) Moreover, of the two species in question the following samples (50 seeds from each), whose origins are not so definitely known as that of the afore-mentioned have been examined: 15 Danish (7 Tystofte No. 152), 10 Westernwolths Grass (from the Dutch State Seed Testing Station at Wageningen), 3 French, 1 New Zealand and 1 Argentina. On an average, 5.8 per cent. of seeds without teeth at the middle portion of the marginal nerves of the outer palea — varying from 0 to 10 per cent. — were found in these samples, but in respect of these seeds the same holds good as stated in paragraph (2).

B. *Perennial Rye-grass.*

(1) As in the case of Italian Rye-grass, seeds of Perennial Rye-grass were harvested from 25 single plants, from different plots in the experiment garden of the Danish State Seed Testing Station; 12 of the 25 plants were of the Danish Lundbaek strain, 2 were described simply as Danish, 7 Irish, 2 Scotch, 1 English and 1 Polish. 50 seeds from each plant were examined.

With the exception of 1 "uppermost kernel", which has teeth

from the top down to a little below the middle, teeth were not found at the middle portion of the marginal nerves (Fig. 14β).

(2) In 1920 we received from H. N. FRANDSEN, the experimental farm "Otoftegaard", comprehensive and valuable material consisting of 165 samples of seed from single plants of the Lundbaekstrain, the mother plants of which in most cases had been isolated. Of each of these samples 100 seeds were tested. In 150 of the samples no teeth were found at that portion of the marginal nerves of the outer palea marked *b* in Fig. 2. In the other 15 samples 60-100 per cent. toothed seeds were found. In 6 of these samples, moreover, the greater portion of the seeds were awned. 4 samples, contained, on an average, 5.5 per cent. seeds without teeth, being similar in this respect to Italian Rye-grass, according to our observations, 5 samples contained, on an average, 24 per cent. seeds without teeth.

At our request, H. N FRANDSEN has very carefully gone through his notes on the cultivation trials with the 15 plants in question and others of the same parentage. So far as 13 of these samples were concerned, it could be shown that the mother plants had been hybrids (crosses between the two Rye-grass species in question). As regards the remaining two samples (Nos. 56 and 88) it was impossible to demonstrate that crossings had taken place On the contrary, Mr. FRANDSEN had suceeded in producing from plants of exactly the same strain as those mentioned, individuals having the appearance characteristic of Perennial Rye-grass. The only samples for which the criterion "marginal nerves without teeth" did not hold good were Nos. 56 and 88; these will be sown to ascertain, if possible, whether they are hybrids.

Further I have several times had the opportunity of making observations on some hundreds of single plants of Perennial Rye-grass which were planted out at "Otoftegaard" for the purpose of improvement. All of them — with the exception of one (probably a recessive form from an accidental cross) — had marginal nerves without teeth.

(3) The following samples, whose origins are not so definitely known as those of the samples mentioned in paragraph (2), have been examined; 5 Danish (the Lundbaek strain), 3 Scotch, 2 Irish, and 2 New Zealand. In no case were seeds found having teeth at the middle portion of the marginal nerves.

(4) Several samples sent in for testing at the Danish State

Seed Testing Station have shown the same criterion. In those cases where toothed seeds occurred in the samples, awned seeds were also found in the purity determination.

Mention should also be made of the fact that during these three years work in the laboratory and in the field, I have frequently made observations on seeds of these two Rye-grass species. For the purpose of control we have sown a few seeds in sterile soil, but unfortunately most of the plants were destroyed by frost in the hard winter 1923-24. The remaining plants, however, proved that the conclusion already reached was correct.

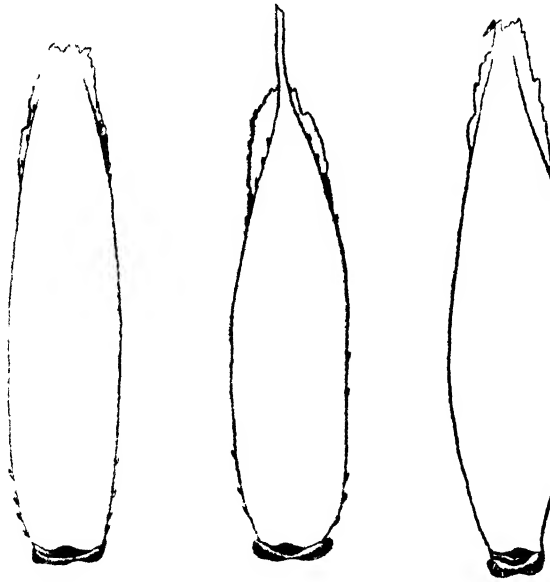
Finally, stress should be laid on the fact that the two closely related species in question easily cross with one another, and that it may never be possible to find a method or testing in which the possible presence of hybrids thus produced can be ignored. In order to be able to form an opinion as to the occurrence of such types, sowing and artificial crossing are of course necessary.

II. *Rye-grass — Meadow Fescue.*

The criterion most often used by the Seed Testing Stations to distinguish between Rye-grass and Meadow Fescue (*Festuca pratensis* Huds.) is the difference in shape of the rachilla. This criterion, which has been described by a number of authors, will in most cases suffice, but now and then such seeds occur as are difficult to determine because the shape of the rachilla is not typical of either of the species in question, or because the rachilla is entirely absent. In such cases it is desirable to have other criteria.

Mention should therefore be made of the fact that when the basal parts of seeds of these species are seen from the back, differences are revealed at the point where the seed has been attached to the spikelet. Perennial Rye-Grass seeds have most frequently narrower and more tightly fitting " basal parts " (Fig. 15δ) than those of Italian Rye-grass (Fig. 15ε), but the difference is not sufficiently distinct to afford a certain means of distinguishing between them. It can only be employed as confirming a determination of the identity of the species. The " basal part " of Meadow Fescue is, on the contrary, generally broad and so to speak " clubbed " and there is a very open furrow between the " basal part " and the seed (Fig. 15ζ). Further, the shapes of the seed of the species in question are

somewhat different. The seed of Perennial Rye-grass is nearly rectangular, that of Italian Rye-grass oval, and that of Meadow Fescue a little wry, notably tapering off towards the base.



δ ε ξ

Fig. 15. δ = *Lolium perenne* L.
ε = *Lolium italicum* Braun.
ξ = *Festuca pratensis* Huds.

In contradistinction to those of Rye-grass, seeds of Meadow Fescue are all smooth ; they are only exceptionally furnished with comparatively small teeth at the upper portion of the outer palea.

The teeth at the nerves of the inner palea are smaller than those of Rye-grass.

E. Hellbo

Assistant to the Danish Seed Testing Station.

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Abstracts and Literature.

The Evaluation of Hard Seed.

BROWN, E. (United States Department of Agriculture). *Report of the Fourth International Seed Testing Congress in Cambridge, 1924.* London, 1925.

The Association of Official Seed Analysts of North America have, in consideration of the importance of establishing a uniform basis for labelling seeds, adopted, the following rule :—

"In reporting the germination of samples of leguminous seeds, a portion of which usually remains hard at the end of the test (*i. e.* does not take up water readily under normal conditions for germination), the actual percentage of germination should e reported, and also the percentage of seed remaining hard ".

The need for further investigation on the adequate evaluation of hard seeds is now fully recognized by the American Seed Trade.

M. L. Y.

The Determination of the Botanic Identity of Varieties in Laboratories and in Experiment Fields.

CHMELAR, F., Director, Seed Testing Station, Brunn. *Ibidem.*

Attention is drawn to the importance of preparing a detailed description of the characteristics of varieties both in the field and in the laboratory to assist in the drawing up of guarantees of genuineness and purity of seed.

The author describes some of the more frequent characteristics associated with varieties of sugar beet, potatoes, wheat and barley

An exchange of observations taken on trial grounds in various countries would be very beneficial in this respect.

M. L. Y.

Seed Testing.

CHMELAR, F. (Director, Seed Testing Station, Brunn). Study of the methods and standards established with a view to regulating seed testing, and the regulations concerning the foreign and home seed trade. *Publication of the Ministry of Agriculture*, No. 33, 312, pp. 57 illustrations. Prague, 1923.

The author discusses critically the various methods of seed testing employed in the different countries and in Czecho-Slovakia. He describes in detail especially the method adopted in Austria, Germany, Hungary, Switzerland, Denmark, Holland, and in the United States, and makes a short review of the situation and work of the Seed Testing Stations in Sweden, Norwy, Finland, England, France, Belgium, Yugo-Slavia, Spain,

Roumania, Poland, Russia, Italy, Canada, Japan, Australia, New Zealand, and Uruguay. Reference is made to the 3rd International Seed Testing Congress held in Copenhagen 6th-10th June, 1921 ; to certain new methods of testing, the PIEPER, HEINRICH, and NEMEC-DUCHON methods ; the determination and provenance of seeds ; to the identification of potato varieties, and to certain apparatus useful in seed testing.

In the second part, the author deals with official regulations established in the various States with regard to the seed trade. A short account is given of State regulations adopted in other countries (Holland, England, Canada, France, United States, Hungary) and examples are given of laws and ministerial orders put in force in Czecho-Slovakia with reference to such questions.

A comprehensive bibliography of 483 titles is appended.

M. L. Y

Germination Test at Low Temperature, with particular Reference to Seeds which are not fully After-Ripened.

FRANCK, Dr. W. J. (Director, State Seed Testing Station, Wageningen). 3 figs., bibliography. *Report of the Fourth International Seed Testing Congress in Cambridge, 1925.* London, 1925.

Germination at low temperature is discussed under two headings :— physiologically unripe seeds, and seeds which are after-ripened, that is to say the artificial ripening of hitherto dormant seeds owing to adverse conditions. This delayed germination has been attributed by some investigators to physiological deficiencies of the embryo, and by others to seed-coat characters.

The author describes in detail the after-drying method employed at Wageningen, which has proved successful in the case of rye, wheat, oats and barley (the last named requiring sometimes a longer period) and also for other seeds such as : (*Alopecurus pratensis, Alpium graveolens, Arrhenatherum elatior* (husked), *Avena flavescens, Cichorium endivia, Dactylis glomerata, Lepidium sativum, Nasturtium officinale, Poa* spp. (*Poa compressa* excepted), *Solanum Lycopersicum*, etc.

Comparative tests were made recently with various flower seeds. A low temperature either constant at 10°C. (e. g. *Chrysanthemum carinatum, Delphinium ajacis, Eschscoltzia* pp.), or between 10° and 20° C. (e. g. *Clarkia* spp , *Lobelia erinus*) is the most favorable. For cereals, a temperature of 10° C. gives the highest germination results.

M. L. Y.

The Determination of Plaut Diseases Transmitted by Seed.

GENTNER, G. (Director, Official Seed Testing Station, Munich). *Ibidem.*

The importance of a thorough investigation as to the possible transmission of disease in seeds, is clearly demonstrated in the germination tests carried out in Munich.

The author describes the methods employed and gives a list of the causal organisms (bacteria and fungi) detected in various seeds.

M. L. Y.

The Vitality of Buried Seeds.

GOSS, W. L. (Seed Testing Laboratory, Bureau of Plant Industry, United States Department of Agriculture). *Journ. Agric. Research*, XXIX, 7, pp. 349-362, 2 tables, 1 plate, bibliography, 1924; and *Report of the Fourth International Seed Testing Congress in Cambridge, 1924*. London, 1925.

In 1902, a buried seed experiment was started in the Seed Testing Laboratory, United States Department of Agriculture. Since then viability tests have been continued up to 1923 and a complete record has been kept of the percentage germination in relation to depth planted.

The records given indicate that depth has little effect upon preservation of vitality. The weed seeds show the highest percentage of germination, especially species such as :— *Rumex* spp., *Portulaca oleracea*, *Datura tatula*, *Plantago* spp., *Ambrosia* spp., *Chenopodium* spp., and *Chrysanthemum leucanthemum*.

Of the 107 species buried in 1902, 71 grew in 1903 after one year, 61 grew in 1905 after 3 years, 68 grew in 1908 after 6 years, 69 grew in 1912 after 10 years, 50 grew in 1918 after 16 years, and 16 grew in 1923 after 20 years.

Observations made during the periods indicated, have led to the conclusion that seeds of most weeds when ploughed under will retain their vitality indefinitely during normal crop rotation. This fact renders futile any attempt to control weeds by this method. The preservation of seeds buried in the soil, in order to help maintain a continuous vegetative cover for the land should not, however, be overlooked. M. L. Y.

Some Critaria by means of which Seed of the Poa Species can be Identified.

HELLBO, E. (Danish Seed Testing Station, Copenhagen). *Report of the Fourth International Seed Testing Congress in Cambridge, 1924*. London, 1925.

As criteria in the identification of the most common varieties of the *Poa* species, the Danish State Seed Testing Station has used teeth and hairs at the marginal nerves of the inner palea of the seed. In this report, it is pointed out that the different way in which the teeth are shaped or placed on the upper half of the outer palea, or the absence of teeth, can amongst others, be used as criteria in the distinction between the six most common *Poa* spp. Briefly, these criteria are as follows. —

Poa pratensis L. (Fig. 16*a*) has big, spread teeth on the dorsal nerve of the outer palea; *P. trivialis* (Fig. 16*b*), small and close-fitting teeth; *P. nemoralis* (Fig 16*c*), *P. palustris* (Fig. 17*d*) and *P. compressa* (Fig. 17*e*) have medium sized teeth, slightly bent; *P. annua* (Fig. 17*f*) has no teeth on the dorsal nerve of the outer palea.

The three species with medium sized teeth can be distinguished from each other in the following way :—

P. nemoralis has a hairy rachilla, whereas the other five species have either a smooth or wart-like rachilla.

P. palustris has a yellow shining spot on the upper part of the outer palea.

P. compressa has a short very open seed (*i. e.* fruit together with the inner and outer palea), and most frequently a short and stiff rachilla.

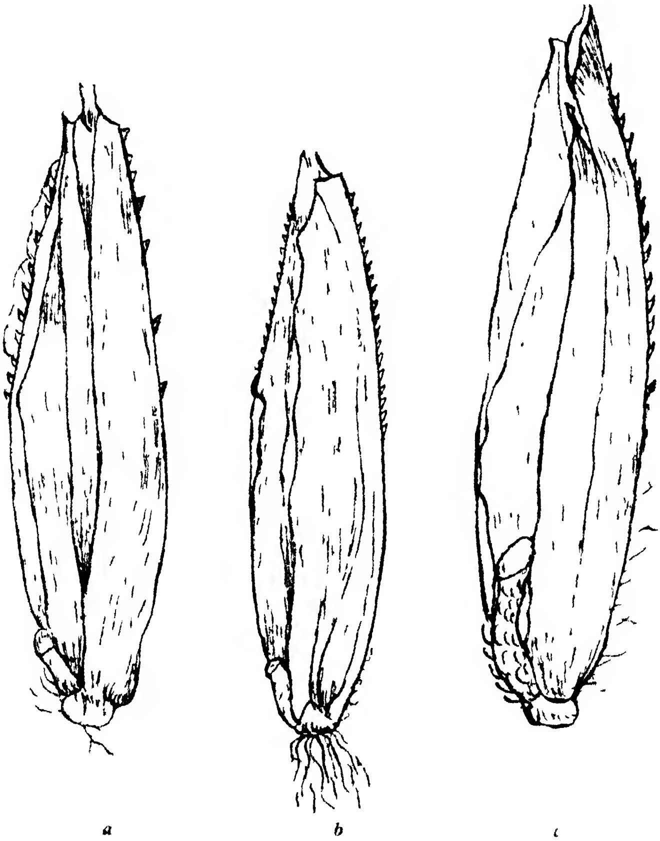


FIG. 16. — *a* = *Poa pratensis* L. — Large teeth on dorsal nerve of outer palea (to right in figure). The inner palea has been removed from the outer palea and the large teeth on the left marginal nerve of the inner palea have become visible (to left in figure).

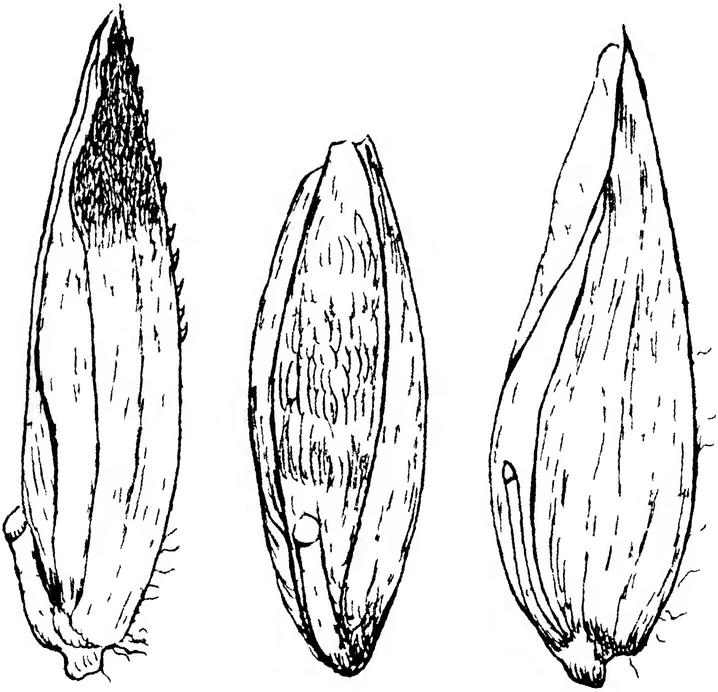
b = *Poa trivialis* L. Small teeth on dorsal nerve of outer palea (to right in figure). To the left part of outer palea has been removed and small teeth on left marginal nerve are visible.

c = *Poa nemoralis* L. Hairy rachilla and medium-sized bent teeth on dorsal nerve of outer palea.

The shape of the seeds of *P annua* differs much from that of the other *Poa* species (see Fig 17 *f*)

In the investigation, a binocular microscope magnifying about 40 times is used The seeds are placed in a row on a slide and take up, as a rule, a position suitable for observation

It is frequently possible under the microscope to see the teeth on the nerves of the inner palea (Figure 16 *a* and *b*) a condition which is often a



d e f

FIG 17 —*d* = *Poa palustris* L. Medium size, bent teeth on dorsal nerve of outer palea Yellow spot on upper part of outer palea
e = *Poa compressa* L. Dorsal nerve of outer palea is not visible as the seed places itself on its back The seed is short and open
f = *Poa annua* L. The shape of the seed differs from that of the other *Poa* species The dorsal nerve of outer palea has no teeth

great help in the identification of a variety By means of the method described, the determination of genuineness of species can be made considerably more rapidly than by means of the method hitherto employed at the Danish State Seed Testing Station, in which the seed before investigation under the miscoscope has to be soaked, in order to prepare the outer palea so that the teeth might be visible

These descriptions are based on observations of threshed seed in the

same condition as seeds generally found in the samples sent in for testing at the State Seed Testing Station ; but the aim has also been to find a method suitable for use in the examinations at the seed testing stations.

M. L. Y.

The Interpretation of Seed Testing Results.

LAFFERTY, H. A. (Head of Seed Testing and Economic Botany Division of the Department of Agriculture, Irish Free State). *Journ. Dept. of Lands and Agriculture*, XXV, 1, pp. 33-39, tables 6, 1925 ; and *Report of the Fourth International Seed Testing Congress in Camqridge, 1924.* London, 1925.

The author discusses the so-called "Irish" method of procedure adopted in testing certain kinds of seeds as compared with the "Continental" method.

According to the Irish" method, empty or only partially filled seeds of the varieties in question are considered as pure seeds, and are included in germination tests. The purity is therefore high, although germination tends to be low The contrary is evident in the Continental system. Such seeds are in this case considered as impurities and are removed before proceeding with the germination test, which is reserved entirely for specially selected seeds.

Improvement in quality of seeds on the market is, however, noticeable since seed-cleaning machinery has been perfected. This is very evident in the case of the improved cleaning of rye grass seeds (*Lolium perenne*), which has resulted in an almost complete elimination of light seeds from commercial consignments.

The hypothesis that lack of uniformity is liable to occur where the Continental system of testing is employed, is shown to be misjudged on examination of the following results of comparative tests with seeds distributed by the Danish Seed Control Station to the principal Seed Testing Stations throughout the world :

TABLE I. — *Results of comparative Tests of Red Clover, White Clover and Alsike Clover.*

Station	Red Clover		White Clover		Alsike Clover	
	% Purity	% Germination	% Purity	% Germination	% Purity	% Germination
Continental method:						
Zurich	96.7	89 + 8	96.9	65 + 21	94.4	90 + 6
Copenhagen	97.5	92 + 6	96.6	71 + 20	94.9	91 + 5
Wageningen	97.1	92 + 6	96.4	71 + 22	95.5	90 + 4
Paris	97.7	94 + 2	98.4	75 + 14	95.0	92 + 3
Cambridge	97.2	91 + 3	97.0	68 + 21	94.4	90 + 4
Edinburgh	98.0	91 + 6	97.4	71 + 18	95.4	90 + 4
Irish method.						
Dublin	98.8	91 + 6	97.8	71 + 15	94.7	89 + 5

TABLE II. — *Results of Comparative Tests of Timothy, Vetch and Swede.*

Station	Timothy		Vetch		Swede	
	% Purity	% Germination	% Purity	% Germination	% Purity	% Germination
Continental method:						
Zurich	98.7	86	90.4	69 + 6	96.7	84
Copenhagen	96.8	88	91.4	75 + 6	98.5	86
Wageningen	98.7	88	86.2	75 + 8	93.5	87
Paris	99.1	90	91,6	70 + 5	98.3	75
Cambridge	96.5	90	88.7	75 + 6	97.3	80
Edinburgh	99.1	89	90.3	68 + 8	96.7	74
Irish method:						
Dublin	98.9	86	91.9	72 + 8	90.3	86

The differences in results (taking into account the limits of latitude, in estimating percentage) are limited. In the case of *L. Perenne* and cocksfoot (*Dactylis glomerata*) the *quality* of the seed is considered the deciding factor, and the wide variations observed in certain cases are limited entirely to low grade seed containing a large proportion of ' light ' seeds. This is shown in the results of comparative tests with fair quality Italian ryegrass seed, compared with inferior samples.

TABLE III. — *Results of Comparative Tests of Samples of Italian Ryegrass Seed of Fair Quality.*

Station	Italian Ryegrass	
	% Purity	% Germination
Zurich	96.6	71
Copenhagen	96.3	71
Cambridge	96.5	71
Edinburgh	97.2	71
Dublin	98.9	70

TABLE IV. — *Results of Comparative Tests of a Sample of Perennial Ryegrass of very Inferior Quality.*

Station	Perennial Ryegrass % Purity	Perennial Ryegrass % Germination
Zurich	80.[illegible]	93
Copenhagen	88	93
Wageningen	[illegible]9.2	93
Paris.	92	92
Cambridge	81.6	92
Edinburgh	83.6	93
Dublin	96.4	[illegible]4

Table of Latitudes for Purity.

When the Purity is	The latitude allowed is
At or between 100-98 %	± 1 %
At or over 90 but less than 98 %	± 2 %
At or over 80 but less than 90 %	± 4 %
Less than 80 %	± 5 %

Table of Latitudes for Germination.

When the Germination is			The latitude allowed is
At or between 100-95 %			± 4
At or over 90 but less than 95 %			± 6
»	85	» 90 %	± 7
»	75	» 85 %	± 8
»	55	» 75 %	± 9
»	45	» 55 %	± 10
»	25	» 45 %	± 9
»	15	» 25 %	± 8
»	10	» 15 %	± 7
»	5	» 10 %	± 6
Less than 5 %			4

In order to avoid conflicting results, the Seed Testing Station at Dublin has prescribed certain fixed rules for the guidance of seed merchants who wish to take a representative sample of a large bulk of seed. Retests are undertaken when differences are reported outside the prescribed limits.

M. L. Y.

The Work of the Association of Official Seed Analysts of North America, 1921-1924.

MUNN, M. T. (President of the Official Seed Analysts). *Report of the Fourth International Seed Testing Congress in Cambridge, 1924.* London, 1925

Since 1921, the seed testing work in North America has progressed considerably, and some twenty or more laboratories can be now relied upon to give dependable results Certification work is based upon thorough training and experience of the analyst, adequate laboratory equipment, quality of work as shown by the results of tests, and the whole-time application of the analysts to testing in its various phases. This system tends to precision and maintaining a high standard of work

The importance of following the fixed rules set out by the Association of Official Seed Analysts is emphasised A purity analysis is not considered complete unless it shows the percentage of pure seed, weed seeds, inert matter and other crop seeds. In reporting upon the viability of a given lot of seed, it is considered advisable to ascertain the percentage of germination in terms of normal sprouts, and in addition, the percentage of hard seeds and impermeable seeds, when testing Leguminoseae.

Questions such as the hard seeds, provenance, vegetable and flower seeds germination, longevity, seed-borne diseases, effects of frost and seed disinfection, are being studied in conjunction with fundamental germination studies upon which testing can be based.

The necessary valuation attached to the sale of seeds is discussed. Statements as to purity, viability and weed seed content, and in many ases, provenance, are considered essential in the seed trade, and the enforcenent of the seed law on a practical basis is urgent.

M. L. Y.

Adulteration of Rape and Turnip Seed with Charlock Seed.

ROGENHOFER (Government Seed Testing and Protection Institute' Vienna). Verfälschung von Raps und Rübssat durch Ackersenfsamen. *Oesterreichische Landwirtschaftliche Marktzeitung*, No. 15, p. 1. Vienna, 16 April, 1925.

Seed testing carried out by the author at the Government Institute showed that much of the rape and turnip seed placed on the market recently, is largely adulterated with charlock seed. The charlock being of a much lower oil content diminishes considerably the usefulness of rape and turnips for oil production, and if used for sowing, since it may cause overgrowing of the fields by weeds, the seed becomes almost valueless. Three samples of rape sent for testing were found to contain 36, 39 and 75 % of charlock seed; three samples of turnip seed were found to contain 45, 47 and 49 % of charlock. The adulteration was much more easily detected in the case of rape, since the rape seed has a diameter of 1.75 to 2 mm., while the charlock seeds have a diameter of only 1.50 to 1.75 mm., and the seeds of turnip and charlock are so very similar in size that they can be distinguished only through careful attention to the colours. The charlock seed

which has been named *B. pullorum* can readily be differentiated from other members of the colon-typhoid group. The hen is the original source of infection and the organism is deposited in the yolk of the eggs from the ovary in which the infection is localized.

The agglutination test is termed positive when the serum is capable of agglutinating the organism in a dilution of 1-100. A positive agglutination test does not indicate infected ovaries in all cases, as the infection may be localized elsewhere in the body. Furthermore, young fowls may retain the agglutination but not the infection, from having had the disease as chicks.

In Holland *Bac.* Klein is given as the cause of bacillary white diarrhoea.
B. I. C. TE H.

A Case of Mange in a Goose.

CIUREA, Sur un cas de gale chez l'oie. *Archiva veterinara*, p. 64, 1925.

Only one case of mange in a goose was reported in 1905, by NEUMANN, which was caused by *Cnemidocoptes prolificus*.

The present case appeared on a young goose, the head and neck of which show bare patches and lumps, more or less solid, about the size of a pin-head, prominent on the external and internal surfaces.

Under the microscope, the formations show a cylindrical canal, the walls of which are lined inside with a very thin hyaline coating. After treatment with alcohol, the canal shows a large number of hexapod larvae, measuring about 135 μ in length and 112 μ in width.

The question of infection by *Cn. prolificus* still remains.
B. J C. TE H.

A Study of Blackhead in Chicks at Missouri State Poultry Experiment Station.

ERIKSEN, S. *Poultry Science*, Vol. IV, p. 250

During the past two years a number of inquiries have been received in regard to blackhead in chicks. This disease has been very prevalent.

Symptoms and lesions are similar to blackhead in turkeys. Losses are usually less severe than in the case of turkeys, varying from one or two individuals to over fifty percent.
B I. C. TE H.

Pseudo-tuberculosis in a Hen caused by *Cladosporium*.

GALLEGO, A. Contribución a la Histopatología de las micosis. Sobre un caso de pseudotuberculosis micótica en la gallina. *Revista de Higiene y Sanidad Pecuaria.* Vol. XV. No. 10.

A case of a pseudo-tuberculous tumour on the neck of a hen caused by *Cladosporium*. The cause appeared to be tuberculosis, but a microscopical examination made by the author showed that this was not the case In the tissues no tuberculous bacilli were found, but after treatment with silver carbonate *Cladosporium* was discovered.
B. I. C. TE H.

Vaccine Therapy of the *Epithelioma Contagiosum* of Fowls.

GALLI-VALERIS, B., Impftherapie der Geflugelpocke. *Schweizer Archiv für Tierheilkunde*, p. 243. Lausanne 1925.

Epithelioma contagiosum of fowls, a fairly frequent disease in certain countries, does not seem to be very prevalent in Switzerland. In 27 years the author has seen only one case. This fowl showed, besides the localization in the mouth and the eye, *virus* of the *epithelioma* in the form of false diphtheric membranes. GALLI is still of opinion that there are certain bacteria of diphtheric form, quite independent of the *epithelioma*.

TOYODA says that the passing of the *virus* through the rabbit enabled him to obtain a *virus* which, inoculated in the child, the sheep and the fowl, protects them against the inoculation of the vaccine. Vice versa, he has protected man against the *epithelioma* by the intermediary of the vaccine lymph.

HADLEY and BEACH say that one cc. of their vaccine, inoculated under the skin, gives an immunity of two months to more than two years. T. HENNEPE advises this vaccine not only as a preventative, but as a cure.

In two cases GALLI has cured fowls by these injections, and the importance of vaccine therapy in *epithelioma contagiosum* of birds seems to himto be proved. B. T C. TE H.

Experimental Research regarding the Lungs of Birds.

JAULMES, C. Recherches expérimentales sur le poumon des Oiseaux. *Comptes rendus des Seances de la Société de Biologie*. Meeting held 7th. November, p. 1147

In the lungs of birds accumulations of " dust " are found in the middle of lymphoid formations situated on the wall of the mesentery, as well as in the mucous chorion of the parabronchial walls They are also found very exceptionally, in the aerial capilliaries themselves. These dust particles, are either free, or confined, sometimes very numerous in the cells with large clear, more or less coloured nuclei and with abundant protoplasm, granular, and vacuolated.

A pigeon receives in an introchial injection 2 c.c. of a sterilized mixture of oil and carmine. After fixation it is seen that in the lung the oil is stopped only at the entrance to the parabronchi, and is again found there in small quantity, almost all of it is passed directly into the left abdominal aerial sac, where it appears as a red coating, adhering locally to the dorsal and internal part of the sac.

The ciliated parts of the wall of the sac are not modified by contact with the oil, and the epithelium alone seems to react. In the transverse sections, at first the epithelial cellules grow considerably, swell in the cavity of the sac, and finally detach themselves from it. Then these cellules which have become free, attach themselves to the globules of oil and carmine, and absorb them energetically, mixed with numerous *leucocytes* which also take part in the process. A fibrous net fixes these different

elements in its web. At the points of maximum reaction, the epithelium entirely disappears.

It is a question, therefore, of an almost exclusively epithelial reaction comparable, up to a certain point, to that of the pulmonary epithelium of the mammals. This peculiar reaction, and the knowledge of existence of ciliated zones added to the embryological facts concerning the aerial sacs, gives good evidence of their physiological importance and their nature of " bronchial circuits " shown by A. JUILLET.

B. T. C. TE H.

The Macroscopic and Microscopic Anatomy of the Intestine of the Goose and Pigeon.

KAISER, H. Inaugural address 1925, Hochschule Hannover, *Deutsch Tierärzliche Wochenschrift*, p. 729, 1925.

It is scarcely possible to distinguish the individual intestinal sections of birds as can be done in the case of mammals. Dual blind intestines occur. In the goose they are quite well developed, in the pigeon only slightly. These caeca serve principally to split up cellulose.

In the case of the goose the author found a *valvula ilioiaeiocolica* at the place where the blind intestine opened into the *ilium*

The total length of the intestine depends partly on the food The intestines of geese which have a very large amount of fodder, are longer than the intestines of those which feed exclusively on grain.

The intestine of the goose and the pigeon is lined with hairy tufts. Structural folds are absent from the small intestine In the case of the pigeon there are no *noduli lymphatici*, but in the goose they are found on the side opposite to where the mesentery is fixed.

Their direction of length lies parallel to the direction of length of the intestine. In the smaller intestine of the goose the author found two types of tufts :

(1) those with a wide base and relatively small height ;

(2) those with a narrow base and relatively great height.

The tufts are arranged in two step-like rows.

The *tunica muscularis mucosae* in the intestine of the goose consists of longitudinal and circular layer. The longitudinal muscular layer is not very prominent.

The genital glands are alveolary-tubular in the pigeon, and tubular in the goose. B. T. C. TE H.

Fowl Typhoid and Fowl Cholera.

KAUPP B F and DEARSTYNE, R. S. (Agricultural Experiment Station, North Carolina State College of Agriculture and Engineering).

An interesting report on two dangerous poultry diseases which are found probably in all countries where poultry husbandry is practised. In the introduction KAUPP says : " Intensive raising and forced production has separated the domestic fowl so widely from its original primitive

condition that its susceptibility to disease is greatly increased. The information of the average poultry man as to poultry diseases is meagre. Frequently diseases are allowed to become well established before the seriousness of the position is recognized. A rapid correction of such conditions is impossible. It must be brought about by education through all possible agencies ".

The subject of this bulletin is the investigation af septicaemic diseases of poultry in North Carolina, a subject of great economic importance to the State.

The historical account begins with the investigation of the Italian physician BARONEO who, with MIOCCHI and BRUGNATELLI examined epidemics among poultry in Lombardy between the years 1709 and 1790.

The first reference however to the typhoid-like disease of birds in which the organism is given a definite name is that of G. KLEIN in 1889, who gives details of an extensive epidemic among fowls in Kent, (England). MOORE described in 1895 the same bacterium under the head of *Bacterium sanguinarium*.

More recent publications are: SMITH and TEN BROECK (1915), RETTGER and KOSER (1917), GOLDBERG (1917), HADLEY (1910), TE HEUMPE and VAN STRAATEN (1921), TRUCHE (1923).

In 1924 the North Carolina station published a comparative study of the European strains of avian typhoid with those of North America, no outstanding difference being found in the biological activities or in the general character of the disease produced by these various strains.

The causative organism is known as *Bacillus gallinarum*, or KLEIN'S bacillus and in 1917-20 the Society of American Bacteriologists adopted the classification of BERGEY and gave the causative organism of avian typhoid as *Eberthella sanguinaria* (MOORE), by which name it is now recognized by the American school.

KAUPP gives further cultural characteristics, field studies, symptoms of the disease, artificial infection, pathological anatomy, control measures.

In the summary it is stated that: 1. The disease is probably prevalent in all countries where poultry husbandry is practised.

2. Avian-typhoid is non-pathogenic to man. Chickens are very susceptible to the disease, turkeys and guinea fowl are less susceptible, pigeons, ducks and geese are only slightly susceptible. Young chicks probably are not susceptible under field conditions.

The causative organism has many features in common with members of the colon-typhoid group.

3. The carrier of avian typhoid is a menace to poultry. Sparrows and pigeons have been shown to be conveyors of the disease.

4. Typhoid may be controlled by sanitation, isolation, or destruction of suspects, safe disposition of the carcasses of birds dying of the disease, disinfection of drinking water and the prophylactic vaccination of healthy birds. Vaccination produces an immunity of unknown duration but the single inoculation should immunize the bird for the period of duration of the disease in the flock. B. I. C. TE H.

The Effect of Lactic Acid on *B. pullorum*, *B. avisepticus* and *B. sanguinarium* and its Influence in the Control of Intestinal Disease of Poultry.

KAUPP, B. T. and DEARSTYNE, R. S. *Poultry Science*. Vol. IV, p. 242.

The investigation has a practical bearing on the lactic acid value of buttermilk as used for poultry feeding, since the lactic acid is not destroyed in the preparation of either condensed or dried buttermilk.

By these experiments it is shown that the effect of lactic acid in milk is to create a field in the intestinal tract, unfavourable to harmful bacteria. B. I. C. TE H.

Goitre in Poultry.

KEMKAMP H. C. H. (Minnesota Agricultural Experiment Station). *Journal of the American Veterinary Medical Association*, p. 223, 1925.

Goitre occurs most frequently in man, but also in all domestic animals. There are few reports of it having been found in birds

Of 2409 autopsies on poultry for the past six years, from all sections of Minnesota, only two cases of goitre in birds were reported. Both were White Orpington hens and came from the same farm.

One of these hens is shown in an illustration. The thyroid gland measured 3.2 cm. in the antero-posterior diameter, and 2.5 cm. in the transverse diameter. Microscopic section showed that the cause in those cases was simple goitre. B. I. C. TE H.

Avitaminose in Relation to Poisoning.

MORSELLI, G. *Biochimica e terapia sperimentale*,. I, p. 1, Milan, 1924.

In all experiments for the closer chemical determination of vitamins this crucial point of the subject has as yet scarcely been approached. It is now sought by new means to clear up the question of *avitaminose*. A material deficiency can theoretically be brought about by a disturbing foreign body being introduced in the course of the cell chemistry. If this foreign body retards a physiological cell-constituent in its function, then this is equivalent to deficiency, if the total effect be considered. A body which interrupts the process of the cell chemistry can very easily become a poison. In this manner we attempt to connect toxicological investigations with *avitaminose research*. The author made use of the *tetanus* and *dysentery toxinus*, and obtained results similar to those of SETTI and TAXAWA. B. T. C. TE H.

Influence of the Sympathetic Nerves on the Movements of the Muscular Stomach of Birds.

NOLF, P. Inflluence des Nerfs sympathiques sur la motricité de l'estomac musculaire de l'oiseau. *Comptes rendus des séances de la Société de Biologie, Société Belgee* p. 839. Meeting held 25th July 1925.

In birds, the sympathetic nerve fibres going to gizzard and the duodenum start from the 3rd. to the 5th. dorsal nerves. They go to-

wards the origin of the coeliac artery, and form a nervous plexus intimately attached to this vessel. The nervous fibres destined for the gizzard and the duodenum follow the branches of the coeliac artery which are distributed to these organs. Each of the four branches originating from the coeliac nerves contains motor and inhibitory fibres, with a predominance of inhibitory fibres in the branch issuing from the 6th. dorsal nerve.

The gizzard and the duodenum of the bird, therefore, receive motor fibres and inhibitory fibres from the vaque and coeliac nerves.

Contrary to what is usually seen when an organ is furnished with a sympathetic and non-sympathetic nerve system, there is not, as regards the gizzard of graminoivorous birds, any real functional antagonism between the fibres of the vaque and the fibres of the sympathetic nerves. Each of these nerves can function negatively, since each contains motory and inhibitory fibres.

In accordance with the lack of functional differentiation between the fibres of the vaque and the sympathetic, it is found that atropine suppresses the motory effect on the gizzard and duodenum as completely for the sympathetic as for the vaque.

A sufficiently intense excitation of the peripheral end of a vaque nerve, or of the cut coeliac nerves, is capable of provoking a series of rhythmical contractions of the gizzard If, shortly after the commencement of a series, there is substituted, for the air which the animal is breathing, air mixed with carbonic anhydride or hydrogen, the contractions stop, but are resumed if pure air is given

From what occurs, it seems as though the excitation of a mixture of motory and inhibitory fibres were followed by a motory or inhibitory effect, according to the contents of CO_2 and O_2 in the blood which bathes the neuro-muscular junction

In four experiments anaesthetization did not stop the excitation of the ganglionic cellules, but prevented them from acting on the muscular tissue.

B. T. C. TE H.

The Barnevelder.

POWELL-OWEN, W. Published by the *Feathered World*, 9 Arundel Street Strand, London W. C. 2.

This fully illustrated book, by the well-known club judge of the British Barnevelder Club, contains a detailed description of the standard bird, with some excellent plates of plumage, for the benefit of the beginner. Also much general information on colour breeding, selecting for shows, and laying tests, and exhibitions of breeds.

The rise in favour of Barnevelders came so suddenly and has spread so rapidly that very many think that it is an entirely new breed, which is not the case, as, if we were not familiar with the breed name we were quite accustomed to the trade-term, " Dutch all-browns ", which covered their products on the London egg market. It is of interest, however, to note that " Dutch all-brown " eggs realised regularly more per dozen

than the best English eggs. Size and colour were alone responsible for the increased prices for the Barnevelder eggs sent to us from Holland.

The British Barnevelder Club was formed in May 1922, the standard drawn up and submitted to the Poultry Club for recognition and acceptance, and the first Club Show was held in 1923 at Olympia. In the same year a section for the breed was arranged at the Harper Adams College laying test, there being twelve entries.

The Club already has about 200 members The Dutch standard gave much difficulty to the British breeders. There is a difference between the British and the Dutch standards The British standard allows for two varieties of hens, viz , the Double-Laced and the Partridge. The splashed pattern did not gain favour in England. In Holland, the Barnevelder Club has only one standard, the double-laced, which is called the exhibition-variety.

The illustrations of plumage in this booklet are very clear

With reference to the Black Barnevelder the author says · " I have always supported the Black Barnevelders because I consider that the more varieties of a breed there are, the greater is its strength ".

B. I C TE H

Text-book on Poultry Diseases.

REINHARDT, Dr R Leipzig, *Lehrbuch der Geflugelkrankheiten*, 2nd Edition, published by M and H Schaper, Hannover, 1925

The first edition appeared in 1922, and now the second has been issued The book is very much improved, and recent publications have been taken into account Two new chapters are added on tumours and malformations. The number of illustrations has also been increased The book can be recommended for European conditions. B T. C TE H.

The Occurrence of Organisms Resembling Actinomyces in the Caecum of a Hen.

ROSKIN, G Ueber das Vorkommen von aktinomycesartigen Organismen in einem Huhnersarkom. *Centralblatt fur Bakteriologie, Parasitekunde und Infektionskrankheiten*, Part II, p. 472, 1924.

Communication on the occurrence of bacteria resembling *actinomyces* in a circular-celled caecum from near the crop of a hen. In connection with this, the author asks whether the infectiousness of the caecum of a hen cannot perhaps be traced to a parasitic source. B. T. C. TE H.

The Histology of the Thyroid Gland of Birds.

SCHESKIN, J. (Veterinary High School, Vienna). Beitrag zur Histologie der Vogelschilddruce. *Wiener tier. Monatschr*, p. 575, 1925.

The thyroid glands of the domestic cock, turkey-cock, goose, duck, crow, partridge, pigeon, jay, blackbird and sparrow were examined. With the larger birds the thyroid gland is egg-shaped, caudal, with a yel-

low appendix. The presence of a *membrana propria*, as recorded in literature, is not corroborated. There is no regular law shown in the protoplasmic structure in a bird species The older the individual is, the more strongly coloured are the follicle contents. The KRAUSE colloid colouring does not give uniform results with animals of the same age of different species, so that this technique cannot have the importance for the histology of the thyroid gland of birds, which is accepted on many sides with respect to the thyroid of mammals In the interstices of the thyroid gland of birds are often found typical lymph follicles, often with embryonic centres.

B. T. C. TE H.

Esaltin with Avitaminose in Vitro Bio-chemistry and Experimental Therapy.

SETTI, G *Biochimica e Terapia sperimentale*. p 234 1924, p. 553, 25. Milan

The author calls the substance, which in boiling shelled rice increases the energy of germs, esaltin The object of the examination was to determine whether this substance is a crystalloid or a colloidal substance The esaltin proved to be very resistant to heat, and was obtained in the form of crystalloid bodies B. T. C. TE H.

General information.

Circular to the Members af the Association. — I have pleasure in announcing that arrangements have been made with the International Institute of Agriculture, Rome, for the printing in its *International Review of the Science and Practice of Agriculture*, of communications and notes supplied by our Association, which will thus become the medium for dissemination of information relative to Poultry Instruction and Investigation, and will be widely distributed in all parts of the world In that connection are two important factors, namely, that the *Review* is issued in several languages and will be seen by Departments of Agriculture in all countries.

Further, this *Review* is issued four times in each year and every member of the Association whose subscription is paid, will receive free of charge, copies as published.

I am very pleased to say that Dr. B. J. C. TE HENNEPE of Diergaardesingel, 96a, Rotterdam, Holland, has consented to act as Editor. I ask, on his behalf, for your co-operation and support, to enable him to take full advantage of the new arrangement and to make more widely known the results of experience and research, which until now have been available only to a few.

Request is made that bulletins, reports, publications and communications be forwarded as soon as issued, direct to Dr. B. J. C. TE HENNEPE. His attention should also be called to new works on Poultry and if possible, copies should be sent to him so that notices of these may be made in the *Review*.

E. BROWN,

President of the International Associations of Poultry Instructors and Investigators.

SPECIAL ACTIVITIES
OF THE BUREAU OF AGRICULTURAL SCIENCE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

PLANT DISEASES AND PESTS IN HAITI

I.

The most important plant diseases of Haiti are :—

1. — COTTON BACTERIAL BOLL ROT.

This is a disease of cotton bolls which occurs in a very serious form when the cotton bolls mature in wet weather. It very frequently seems to follow the attack of cotton stainers. It may be so severe that during rainy seasons not a single boll will come to normal maturity. The bolls may become soft, watery and rotted during almost any stage of their growth. They finally turn brown and blackish and remain as mummies on the plants. No satisfactory control measures have been worked out. With the annual cottons it would not be such an important disease, since the planting season could be regulated so as to produce fruiting in the dryer season.

2. — COTTON MOSAIC.

Cotton mosaic is also a very important disease in Haiti. It prohibits the profitable growing of certain well established and profitable varieties of cotton grown in other cotton producing regions of the world. The nature of the disease is not well understood. It appears in the native cotton, producing some damage but never becoming a limiting factor. The growing of certains introduced varieties has been abandoned on account of this di-ease. There appear to be very marked varietal differences. The

Plant Pathology Department in co-operation with the Agronomy Department aret esting this year, on the Experiment Station plots, a number of varieties planted at different times in order to determine varietal resistance, environmental factors affecting the disease, etc.

3. — Mosaic of sugar cane.

One of the most serious diseases in Haiti at present, is the mosaic of sugar cane. It is generally distributed and very destructive throughout the Island. Uba, an immune variety, is being grown to a considerable extent by the Haitian-American Sugar Company. The indications are that this or other resistant varieties will greatly relieve the situation. Improved cultural conditions may also greatly aid in keeping the disease under control.

4. — Kernel smut of grain sorghums.

The kernel smut of the grain sorghums (" Petit Mil " in particular) causes much loss in this important food and feed crop. In many fields the damage amounts to 50 % of the crop. It is judged that the average loss for the Island is upward of 10 %,

5. — Mosaic of tobacco.

The mosaic of tobacco is without question the most serious disease of tobacco in Haiti. In the larger plantations of tobacco particular care is now being taken to keep the seed beds and young fields as free of this disease as possible.

6. — Mosaic of beans.

Several varieties of beans, particularly the variety " Red Kidney ", suffer considerable loss from mosaic. Hot weather favors the disease to such an extent that their growth is sharply limited to the cooler season, except in the high mountains.

7. — Mosaic of corn (maize).

Mosaic of corn (maize) is very general and does considerable damage wherever corn is grown in the Republic.

8. — BLACK ROT OF SWEET POTATOES.

The black rot of the sweet potato is of considerable economic importance because of its prevalence and because the sweet potato is an important food crop. The damage from this disease may range up to 90 % of the crop. Very little attempt has been made to control this disease, perhaps largely because it is a local crop grown in small plots

There are in addition to the above many diseases of more or less minor importance, due to the fact that they cause periodic or slight damage to important crops or else the crops upon which they occur are not economically important crops.

* * *

A new disease to which particular attention has been given this year is the fruit rot, or black rot, of pineapple This disease appears on fruits that are nearly mature. It is rarely found on fruits that are more than ten days from ripeness necessary for canning purposes. One or more eyelets may be infected or in severe cases the entire inner portion of the fruit is affected. In no cases are there external indications of the disease The disease commences as brownish spots in the placentae or as brownish strands in the eyelets, spreading until the entire eyelet is browned or blackened by dry rot, which may or many not spread to adjacent eyes, but does not affect the connective tissues. It is an extremely serious disease of pineapples affecting perhaps 50 % of the fruits, rendering them unsuited for canning or for shipping during the season when the disease is severe. It is a very complex disease. It has been previously noted in the West Indies. Brief notes concerning its occurrence may be found, but the cause or control measures have never been determined. Extensive experiments are now being made to ascertain the cause and to devise possible control measures.

* * *

The Plant Pathology Department of the Technical Service, Department of Agriculture, Haiti, has, since its initiation some fifteen months ago, been making an intensive survey of the plant disease problems existing in Haiti. These observations have been

recorded on a plant disease survey form. Much valuable information concerning the prevalence, distribution, and seriousness of the economic diseases has thus been gained. Two definite research problems have been undertaken. The first of these is the fruitlet rot or black spot of pineapple described above. Isolation of various fungi, yeasts and bacteria have been made and inoculations effected. The reactions of the inoculated fruits are now being studied in the field. Various physiological factors which may in some way cause or contribute to the disease are also being studied under field conditions. Varietal tests and selection experiments are also being started. The second problem receiving attention is the mosaic of cotton. Very little has been published concerning the nature and cause of this disease. We have obtained seed of as many varieties of cotton as were available and are making comparative planting at various seasons to study the various seasonal effects upon the development of the disease, to study varietal resistance in connection with studies upon infection and the development of the disease. It is proposed to study in this connection the effects of hybridization and selection.

H. D. BARKER,
Plant Pathologist to the Department of Agriculture and Technical Instruction,
Port-au-Prince (Republic of Haiti).

II.

The Insect pests observed in Haiti are :—

1. — INSECT PESTS OF COTTON.

The important insect pests of cotton in Haiti are :—

(*a*) the leaf caterpillar, *Alabama argillacea* Hubner;
(*b*) the stainer bug, *Dysdercus andreae* Linnaeus;
(*c*) the red spider, *Tetranychus bimaculatus* Harvey;
(*d*) the white scale, *Hemichionaspis minor* Maskell.

The Pink Bollworm, *Pectinophora gossypiella* Saunders, is a serious pest on Sea Island cotton, but does little damage to native cotton, which is more extensively grown.

2. — Insect pests of coffee.

Coffee has not any serious insect pests.

3. — Insect pests of sugar cane.

The seed of sugar-cane is attacked by a termite, *Nasutitermes (Tenuirostritermes) pallidiceps* Banks, which also sometimes does serious damage to corn. The leaves of sugar-cane are often eaten by a caterpillar, *Calisto pulchella* Lathy, the stalk is bored by the caterpillars of *Diatraea saccharalis* Fabricius, and the roots are eaten by white grubs, *Lachnosterna hogardi* Blanchard. Sugar-cane, and to a much greater extent, corn, is often damaged by army-worms, *Laphygma frugiperda* S. & A

4. — Insect pests of sweet potatoes.

Sweet potatoes are attacked by the weevil borer, *Cylas formicarius* Fabricius.

5. — Insect pests of bananas.

Bananas are attacked by the root borer, *Cosmopolites sordidus* Germar.

6. — Insect pests of coconut-trees.

Young coconut trees are often attacked by rhinoceros beetles, *Strataegus quadrifoveatus* P. B., and the leaves by the scale *Aspidiotus destructor* Signoret.

7. — Insect pests of citrus trees.

Citrus trees are infested with most of the common scale insects, as well as by the black fly, *Aleurocanthus woglumi* Ashby.

* * *

Demonstrations in the control of the cotton caterpillar have been made by the Technical Service, showing the desirability of dusting with arsenicals, and the largest cotton plantation in the country has replaced its spray pumps with dust guns.

A demonstration on the destruction of the West Indian Cane Leaf-Hopper, *Saccharosydne saccharivora* Westwood, by means of dusting with calcium cyanide was made, but this was thought too dangerous for use by ordinary labor, and what at one time threatened to become a serious outbreak gradually disappeared, due to natural causes.

Demonstrations in the destruction of ants, especially *Solenopsis geminata* Fabricius, by means of the BARBER formula of poisoned syrup, both in houses and around citrus trees have been made, and in the destruction of termites, *Nasutitermes morio* Latreille, by placing arsenicals in their nests. These have been made directly by the Department of Entomology, and do not include those made by agricultural agents or teachers, nor instructions given to other persons for the control of insect pests.

GEORGE N. WOLCOTT,
Entomologist to the Department of Agriculture and Technical Instruction, Port-au-Prince (Republic of Haiti)

AGRICULTURAL INTELLIGENCE

ECONOMICS.

Economics.

1. **Diversification of Crops.**

Tropical Agriculture, Vol II, No. 5, pp. 93-94. Trinidad, 1925.

The recent depression in certain tropical products brings into prominence the fact that one-crop areas are based upon an unstable economic foundation. While the main crop is in demand at remunerative prices the country prospers, but when any disaster overtakes this crop the whole area is thrown into profound depression. Much may be said in favour of specialization of large areas, but the inherent danger of the system should always be remembered by planters and administrators.

A well-known example of a one-crop area is that of the coffee industry of Ceylon, which was prosperous until in 1868 the disease *Hemeliea vastatrix* appeared and practically destroyed the industry. Other crops were then cultivated, and salvation was ultimately found in tea, which was introduced on sound economic lines; although the failure of the Ceylon tea industry would be very serious for the island, owing to the introduction of other crops, such as cinchona, cinnamon, rubber and coconuts, the effect of failure of tea would not be so disasterous as was the case with coffee.

A more recent example is that of the rubber industry of Malaya, and also that of Ceylon, in this case due to over-production, with the consequent fall in market prices.

Another instance is that of cocoa; the production of the Gold Coast rose from 39,000 metric tons in 1912 to 194,000 tons in 1923. Recently prices fell, owing to a variety of causes, with serious results to the producing areas.

A remedy may lie in cooperation to extend the market, to limit production, or by publishing reliable information regarding stocks and supplies. The chief remedy however lies in a greater diversification of crops.

The danger is again illustrated on a smaller scale by the failure of

the lime industry of Montserrat, brought about by disease, hurricanes and competition of the Italian lemon industry.

There are many minor crops in the tropics which could be developed into profitable industries if they received adequate attention.

The need is urged for practical recognition of the necessity of broadening the economic basis of those tropical areas whose fortunes are founded upon the continued prosperity of one main crop.

W. S. G.

2. Dairy Farming on Arable Land.

University of Leeds, Bulletin No 138, pp. 53, plates 4, graphs 4, charts, 2. Leeds 1925.

The Bulletin gives an account of a system of cutting and feeding of green forage to dairy cows, to supplement or take the place of pasture during the grazing season. The work was carried out at the Soiling Farm, Rawcliffe, Yorkshire, from 1920 to 1924.

The Bulletin describes: the experiments and the results obtained; the factors which affect the relative efficiency of soiling crops and grass pasture for milk production; the possibilities of reducing the cost of milk.

In an appendix are shown: details of cropping; annual valuations; tables comparing economic results with those of other farms in Yorkshire; graphs of milk yields; charts of schemes of cropping. W. S. G

3 Hard Winter Wheat Grower's Problem.

GRIMES W. E (Kansas State Agricultural College) *Journal of Farm Economics*, Vol VII, N° 2, pp. 196-219, tables 9. Columbus, Ohio, 1925.

The author discusses the various conditions brought about during and after the War, their effects on production in the winter wheat belt, and the adjustments which farmers must now make owing to changed conditions of production and altered price relations.

The different aspects of the problem are treated and the following recommandations made.

1. Adjust the wheat acreage per farm to that which can be sown properly with the usual labour force and equipment of the farm.

2. Produce dark, hard, high protein content wheat for which millers are paying premiums.

3. Secure for the grower the premium paid for high grade wheat.

4. Encourage cooperation by farmers, and the adoption of improved varieties of crops.

5. Encourage the keeping of livestock on the wheat farm, to utilize labour, bulky feeds and by-products.

6. Educate the farmer with respect to improved methods and market demands. A market news service is essential.

7. Research work on production and marketing is necessary.

There are many other allied problems such as credit, transport, taxation, etc., but the author is of opinion that the adjustement which may be

made by the individual farmer are the most fundamental, as the ultimate solution of the present difficulties is dependent upon individual action.

W. S. G.

4. The Economic Interpretation of the Results of Fertility Experiments.

WORTHEN, E. L. *Journal of American Society of Agronomy*, Vol. XVII, No. 4, pp. 233-244, tables 4, bibl. Geneva, N. Y., 1924.

The author is of the opinion that calculations of financial returns from fertiliser experiments are almost without exception favourable to the fertiliser.

The various factors which influence the accuracy of the financial interpretation of results are discussed, examples are given, and the following conclusions drawn:

Adequate consideration has not been given to error in calculation of financial returns from fertiliser plot experiments. As a result the conclusions indicate a most liberal return on the fertiliser investment.

Conservation in determining financial returns from experiments is highly desirable, and particularly so in periods of general price decline of agricultural products.

Unless financial conclusions conform more nearly with the returns that would be secured in actual farm practice, farmers may disregard all agronomic teaching.

W. S. G.

5. The Economics of Soil Liming.

SLIPHER, J. A. *Journal of the American Society of Agronomy*, Vol. XVII, No. 4, pp. 211-232, figs. 12. Geneva, N. Y., 1925.

Increase in crop yield resulting from a particular soil treatment is of academic interest and is a scientific index of soil plant relationship. The true measure rests upon the net value of the produce above its cost of production.

The outlay in liming, in addition to the cost of material, should include the cost of harvesting and marketing the crop increase. The liming costs proper should include cost of material, freight, expense of wagon haul, and spreading on the land. Wagon haul costs 50 cents for the first mile and 30 cents per ton for each additional mile.

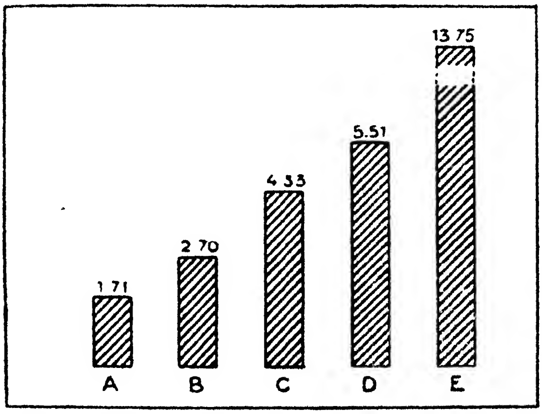


FIG. 18. Area per year from individual crops. Dollars per acre — Net profit.
A = cereals, B = other forage, C = pasture, D = legumes, E = roots.

Spreading costs per acre, 57 cents for a 500 lb. application and $1.60 for 8000 lb.

The first gain from liming is that cost of tillage is reduced. Capital or land profit is the second. One dollar net return in crops per year justifies $10 higher land value. The land profit, based on returns from tests in 17 States, amounts to $40 per acre.

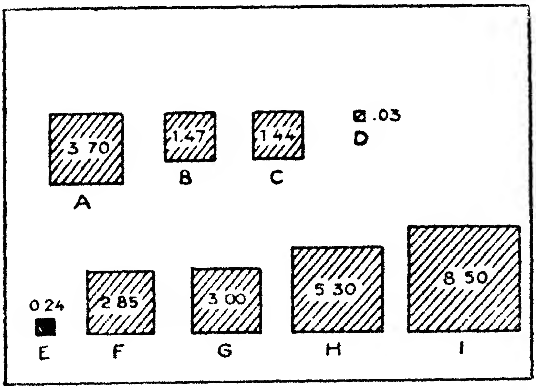


FIG 19 — Net profit from crops, by types Dollars per acre per year
A maize, B = rye, C - wheat, D - oats, E = cowpeas, F = timoty, G = soybean, H = clover, I - alfalfa

The third gain is that of crop increases, the value of which is sufficient to afford a net profit of $4 per acre per year.

Considered as an investment, liming has returned 138 % on all outlay in the 17 States studied.

Root and legume crops gave the highest profits from liming and cereals the least. Alfalfa gave the greatest return, followed by clover, soy bean, timothy, maize, rye, wheat and oats.

Light applications proved the best investment in 13 comparative tests ; a single application was always more profitable than multiple increments. W. S. G.

6. **Payment in Kind in German Agriculture.**

HUCHO, W. Die Naturalentlohnung in der deutschen Landwirtschaft. *Berichte über Landwirtschaft*, Vol. II, No. 4, 80 pp., 13 tables. Parey, Berlin, 1925.

After discussing the development of payment in kind which, under normal conditions is slowly disappearing and giving way to payment in money, the author deals in detail with the pecuniary evaluation of wages in kind. It is necessary for the levying of taxes, for workers' insurances and for the labourer himself, and furnishes data of comparison for the payment of wages in kind as well as in money. The payment of wages entirely in kind hardly occurs anywhere in Germany nowadays. The temporary introduction on the Isle of Rugen as a consequence of inflation, has not proved practical when the return to the normal currency took place. But in times of fluctuating currency the whole evaluation of wages is different, and then it is well to establish as a unity of measure not money, but the chief products of the crops, as these are more or less

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permanent in value, in Germany rye and potatoes are used for this purpose.

Subsequently the author treats of the different sorts of payments in kind at present employed in combination with payment in money, and points out the effect and the importance still due to the former in agriculture and in national economy as a whole. The appreciation of wages in kind in the form of lodgings and land emoluments, he thinks often exagerated, most of all where the land let to the labourer is not permanently held, for instance, where the labourer is given a different piece of land every year on account of crop rotation.

Wages in kind have not prevented unmarried men from leaving the land, but they have done so in the case of permanent, married day labourers, especially where the land given as wages in kind was not changing but settled land. The effects of wages in kind on the working of the estate itself are discussed, and finally the possibilities are considered under which payment in kind may still, and must, play a part in the future.

Above all things, a clear, estimated, commutation of payment in kind into a fixed value, consequently for the time being into money value, is necessary, and this commutation must also be satisfactory to the labourer himself ; and further, wages in kind ought to be given in the actual, exact equivalent of payment in money, and not, as has often been done hitherto, indiscriminately. H. I. H.

AGRICULTURAL INDUSTRIES.

Plant Products.

7. The Nipah Palm and Alcohol Production in British North Borneo.

DENNET. J. H. *Malayan Agricultural Journal*, Vol. XIII, No 3, pp 64-71. Kuala Lumpur, 1925 (1)

It is estimated that there is an area of at least 300 000 acres of Nipah Palm in British North Borneo, available in blocks up to 5000 acres, extending up the river estuaries for distances of nine or ten miles.

Nipah Palm in the Federated Malay States, owing to exploitation, has become an agricultural undertaking, whereas in British North Borneo, owing to different conditions it remains a forest product.

A factory with an experimental plant capable of producing 200 gallons of motor spirit per day has been erected, and tapping the palms for juice was started in January, 1924 and continued until June.

The motor fuel produced consists of about 70 % alcohol and 30 % ether with the addition of 1 % of aniline. It is claimed that the motor

(1) See *R.* 1923, Nos. 112 and 492. (*Ed*)

fuel has an effeciency of 80 %, as compared with petrol, also that engines require less lubricating oil, do not over-heat and require decarbonising less frequently.

It is considered that it should be possible to produce fuel at a price sufficiently low to compete successfully with petrol. W. S. G.

8 Ginning Pima Cotton in Arizona.

TOWNSEND, J. S. *United States Department of Agriculture. Bulletin* No. 1319, pp. 11, plates 11. Washington, D. C., 1925.

On account of the diversity of roller-ginning methods used in Arizona, Pima cotton in the bales often differed so much that it was considered to be uneven in quality. In reality Pima cotton is more uniform than any of the seed stocks obtained from Egypt.

As a result of investigations made by the Arizona Department of Agriculture, an attachment has been devised for removal of the lint from the gin roller in a manner that straightens the fibres and improves the appearance of the cotton ; by the use of the new attachment the cotton is placed in a higher commercial grade.

The Bulletin describes the methods in use for ginning Pima cotton, and contains photographic illustrations of the lint at the different stages of ginning. W. S. G.

9 The Determination of Moisture in Flour.

SPENCER, G. C. (Bureau of Chemistry, U. S. Department of Agriculture). The Quantitative Determination of Moisture in Wheat Flour *Journal of the Association of Official Agricultural Chemists*, Vol VIII, No. 3, p. 311, 7 figs. Washington, D. C., 1925

Grain flour is composed of extremely small particles of an organic body, these particles varying in cell structure and chemical nature and presenting an enormous surface for the attraction and retention of atmospheric moisture. In flour, as in other substances with a cell structure, and in powdered carbon, the moisture is in close contact with the finely divided particles and adheres much more tenaciously than water which may be easily detached from solid surfaces. Also on applying the simple law of attraction it will be understood that, given the influence of the proximity of the water and the particles of flour, it is impossible to drive off all the particles of water, since the vapour pressure is insufficient to overcome absorption.

Hence all the methods hitherto adopted to determine the moisture of flour are liable to err ; the one used must be accepted by all those interested. In the United States a maximum moisture of 13.5 % is allowed and the drying of two grams of flour in a current of dry hydrogen, or in a vacuum at the temperature of boiling water to constant weight (for 5 hours approximately) is prescribed. In this official method however there is no indication of the reduction of pressure used, and this causes various investigators to obtain different results.

The author has made numerous tests with different methods, always using aluminium capsules with a cover, 60 mm. in diameter and 18 mm. deep, and has come to the conclusion that the simplest, most accurate and quickest method is the following: About 2 grams of flour are placed in a closed and covered capsule; the cover is taken off and the capsule kept in a furnace at a temperature of 130°C. for one hour. The cover is then replaced and after the capsule has been left in the desiccator for 20 minutes, it is weighed. A. F.

10. **The Future of the West African Palm Oil Industry.**

BARNES A. C. *Tropical Life*, Vol. XXI, N° 2, pp. 18-19. London, 1925

The growing importance of vegetable oils is obvious, and until recently West Africa was the chief producer of palm-oil and kernels, but competition has arisen owing to the improved methods of cultivation and organisation adopted in Sumatra and Malaya. It is estimated that in five years the export of palm-oil from Sumatra will exceed 60 000 tons per annum.

The author alludes to developments now taking place in Sierra Leone, the Gold Coast Colony, and Nigeria; in the last-named colony attention is being paid especially to native methods of extraction, as the methods now in use are extremely wasteful. It is estimated that the internal consumption of palm-oil in Nigeria is about 100 000 tons per annum.

The author is of opinion that the quantity of oil produced annually could be more than doubled if the whole of the produce of the palms now in bearing were utilised, to the best advantage. W. S. G.

11. **Production of Sweet Silage by American Methods in Austria.**

KUPELWIESER. Maisbau und Erzeugung von Silage nach amerikanischem Rezept. *Wiener landwirtschaftliche Zeitung* No. 10, March 7 1925, pp. 2, figs. 4, Vienna.

The increased importance of dairy farming has had as a consequence in Austria the effort of developing in a higher degree the cultivation of forage by the laying down of artificial meadows and the promotion of grass-seed cultivation. The necessity is evident of devising a better method for the preservation of fodder as hay-making is so often delayed or even prevented by bad weather.

As a consequence, in many parts, different methods for the erection of silos are being tested, as recommended by industry and the inventors. No final opinion can be given as yet as to these trials, largely owing to the fact that the results of silage preparation vary with each year, according to the prevailing weather conditions at the time when the fodder was cut and placed in the silo or brought in for conservation; weather conditions, dryness and ripeness of the fodder itself, method of treatment and many circumstances are all of importance.

An interesting experiment has been made by Dr. Karl KUPPELWIESER who grew maize according to American methods of cultivation and stored it in a silo built from American plans. In so doing he acted upon

principles which, according to ideas hitherto prevailing in Austria, were considered as inadvisable. In Austria maize intended for fodder, is sown as closely as possible and is often broadcast. The object is to suppress the formation of fruit and to use the maize as green fodder as long as the cobs are still tender and small. KUPPELWIESER on the contrary, grew the maize in rows one metre apart and the plants in each row were placed at a distance of 15-25 cm. Here and there sunflower seeds were sown. The field was hoed three times, between the plants.

The harvest began on the 4th of October. The cobs were in a state of milk ripeness, and in the sunnier places showed signs of full ripening.

After drying off during fine weather for several hours the fodder, 1120 meterzentner (220 cwt.) on 5 hectares, was cut into pieces of about 2 cm. by a powerful American chaff-cutting machine and blown into a ferroconcrete silo. This silo had an internal height of 11.60 m. and a volume of 184 cu. metres. Every day a layer of 100 to 150 cm. was filled in and spread evenly and trampled down by a boy. After the days work was done, two men again trampled down the mass of fodder for ten minutes each, especially at the edges. In this also KUPELWIESER abandoned the general Austrian custom, as by having the fodder trodden down he prevented the formation of a high temperature and a strong fermentation. As the fodder never got warmer than 30°C no butyric acid bacteria developed, the formation generally of which is suppressed by spreading the fodder lightly and so trying in order to obtain quickly a temperature of 55-60° C., which prevents the development of the butyric acid bacteria. However it almost always happens that butyric acid is formed during the time in which the heating of the silage takes place and when its temperature is above 30°C. and below 60°C. It is obvious that the amount of butyric acid produced is larger when the critical temperature period is prolonged. (This explains why with the method usual in Austria the amount of butyric acid formed in a silo is sometimes considerable in one case, whereas with fodder harvested under better, drier conditions, the quantity is quite small).

By having the mass of fodder trodden down, and so excluding air, KUPELWIESER prevented the formation of excessive fermentation also, the fact that the constituents of the maize were for the greater part in the form of starch and only to a slight extent in the form of sugar, which is more easily fermentable, had a preventive influence on fermentation.

The upper layers of the silage in the silo were covered with maize leaves, but without cobs and then with turnip leaves on which were placed a well-fitting layer of planks on which stones were put. The silo was filled up to a height of 10 m. but after several weeks the fodder had sunk to a height of 8.30 m.

At the beginning of January the cover was lifted and the upper spoilt layer was removed. Only at the borders, where air had penetrated, the fodder had become unfit for use. Where the boards were lying closely on the turnip leaves, these were in excellent condition.

The colour and smell of the fodder were very satisfactory. The individual parts of the plants, such as cobs, stalks and leaves were plainly

distinguishable. The woody constituents were completely softened. The silage is readily eaten by cattle, which are given 10 kg. per day.

The analysis of the fodder was as follows: acetic acid 0.12 %, lactic acid 0.66 %, butyric acid 0.0, water 77.19 %, crude protein 1.79 %, crude fat, 1.15 %, non-nitrogenous extract 10.99 %, crude fibre 6.23 %, ash 2.65 %. The sample was taken 50 cm. below the cover.

The experiment is interesting also for the reason that it was carried out at a height of 350 m. above sea-level, where in the middle of July the temperature only reaches 17.4°C., and which in consequence is not very suitable for maize cultivation. H. K.

12 **Silage Making in Tower Silos.**

AMOS A. (School of Agriculture, Cambridge) *Journal of Ministry of Agriculture*, Vol. XXXI, No. 11, pp. 1046-1051. London, 1925.

In the case of most silage crops grown in Great Britain, such as oat and tare mixtures or first crops of seeds, the most convenient time to make silage occurs between the hay and wheat harvest, or it may be done in periods of damp weather, or at times when haymaking is impossible.

As a general rule a crop for silage should be cut in a state of maturity rather more advanced than for haymaking, because there is much less loss during carting, and as the crop is ensiled shortly after carting there is little chance of any further formation of fibre.

The actual cutting of the crop may present various problems, dependant upon the particular crop and its condition at the time of cutting.

The quality of silage is affected bythe interval of time between cutting and ensiling ; the best type, " green and fruity ", will probably be obtained when the interval is shortest ; acid silage is likely to result if the crop is allowed to become partially dry after cutting ; sour silage will be produced from a crop cut and exposed to rain for some days, so that decomposition starts in the field.

Loading in the field is facilitated by using low carts, or low-framed lorries, and when the crop has been cut and tied with a binder.

The choice of a silage cutter is important, as the speed at which the silo can be filled is largely controlled by the machine which cuts up the crop and elevates it into the silo.

In making silage it is essential to limit fermentation by the exclusion of air ; if air has access to the silage for a continued period, as by cracks in the walls of the silo, then the normal silage fermentation is followed by the growth of moulds and the silage is spoilt. Care must be taken to see that the walls are airtight and that air is excluded by trampling the crop. The level of the silage should be a little higher in the middle than at the sides of the silo.

The filling period should be sufficiently long to allow the silage in the lower and middle parts of the silo to ferment and settle, before completion of the filling. When intermittent filling of a silo is practised, however, the interval between two fillings must not exceed 60 hours, or a mouldy layer will be formed on the top, which will persist.

Under good conditions not more than 6 ins. should be spoilt, but with careless management 3 feet of top silage may be wasted. If on conclusion of filling, the crop is over-mature and dry, it is useful to add water to the crop as it passes into the silage cutter.

Various methods have been suggested for exerting pressure on the top of the silage in order to prevent access of air and thus reduce wastage, such as a layer of soil, or of wheat-chaff, etc. but no method seems truly economical. There is need of a device for the prevention or limitation of wastage of silage at the top ot tower silos. W. S. G.

13 **Flax Factory Management.**

BAKER, E. *Journal of Department of Agriculture, Union of South Africa*, Vol. X, No. 3, pp. 234-256, plates 20. Pretoria, 1925.

The author visited Europe in 1924 to investigate the flax industry with a view to its establishment in South Africa. A great deal of time was spent in studying methods of fibre extraction ; descriptions are given of the following

(a) *Dew Retting*, found to be unsatisfactory under conditions obtaining at Durbanville, South Africa (1).

(b) *River Retting*. the finest fibre produced comes from Courtrai in Belgium, due to the properties of the river : some firms employ warmed river water to hasten the process. Details of processes are given with plans of factories and retting tanks.

(c) *The Peufallit System of Retting*, in which the flax straw is heated with steam under pressure for about 12 hours ; after drying in ovens the straw is ready for scutching The plant costs about £ 10,000. Belfast spinners reported that the flax was lacking in spinning quality.

(d) *Bacterial Cultures*: Professors CARBONE and TOBLER are carrying out experiments at Soran with cultures of *Bacillus felsineus*, but it has not yet been decided whether such methods are economically possible.

(e) *Chemical Methods of Retting*: the allusion to these methods is very brief: the underlying principle is the removal of pectin substances by chemical agency. Spinners complain of a loss of « quality », due probably to removal of the oily matter of the fibre.

Mention is made by the author of schemes for the collection of straw produced by growers, for treatment at central depots, and to the recent tendency in Ireland for the farmer to sell his standing crop in the field; the buyer rets the straw, which he passes on to others who have specialized in scutching. Finally, the fibre is bought by a dealer who grades the fibre and sells it in large consignments to the spinner.

South African straw was treated in Silesia and it was noticed that retting was unsatisfactory owing to inequality in diameter of the straw. Thick straw retted sooner than thin straw, and the latter gave an additional 1.3 % of long fibre. Attention should be given to the production

(1) See *R.* 1923, No 368. (*Ed.*)

of more uniform straw, which renders subsequent processes easier and more profitable.

After retting and drying, straw should be stored for some months before scutching, and in South Africa scutching should be carried out in a humidified atmosphere. The chief fault with South African fibre is that it is more like horse-hair than silk, and as this difference represents from £50 to £100 per ton in market value, every care should be taken at this stage, by the aid of humidifiers, by scutching in winter or by other means, to make possible the production of a high grade fibre.

Breaking and Scutching: There are several kinds of mechanical scutching machines on the market, of which the « Etrich » is described as being the best. The machine is a combined breaker and scutcher, and is in use at one factory at least, in England, the manager of which factory states that the « Etrich » handles the retted straw at a cost of 18s. per ton as against about 80s. for hand-scutching. For the machine to work satisfactorily the straw must be well retted, dry, clean, and evenly fed into the machine. The « Etrich » plant at the above factory cost £2000.

Allusion is made to the different types of hand scutching wheels, e. g., the Irish with 6 heavy blades, the Belgian with 12 light blades, and a modification between the two, found satisfactory in East Africa. The choice of wheel depends upon the nature of the straw and the degree of retting to which it is submitted.

Attention is drawn to the importance of grading the fibre, which should be done only by experts. The article concludes with details respecting cost of production, based on wages and other factors now ruling is South Africa. W. S. G.

14 **Packing Apples in the Okanagan Valley, British Columbia.**

TAYLOR, H. V. *Journal of the Ministry of Agriculture*, Vol. XXXI, No. 11, pp. 1034-1046, figs. 4. London, 1925.

The author gives a brief description of the Okanagan Valley, its soil and climate, followed by details respecting the business methods of several cooperative fruit grower's essociations which have been formed in the Valley. An account is given of the methods employed for receiving, grading and packing, and the dispatch of fruit to the various markets in the United States and to Europe. W. S. G.

15 **Grading, Packing and Handling of Bananas.**

ROWLANDS, W. *Queensland Agricultural Journal*, Vol. XXIII, No. 4, pp. 282-304, plates 97. Brisbane, 1925.

The object of the article is to aid growers in the preparation of bananas for market, so that they may obtain higher average returns and fewer losses.

The methods described are those employed by many successful growers in Queensland who have earned a high market reputation as consistent suppliers of firm, clean and well-packed fruit.

PLATE IV

Fig. [illegible] Choice [illegible] Special [illegible] Standard. Three cases of well-packed bananas as opened in Melbourne

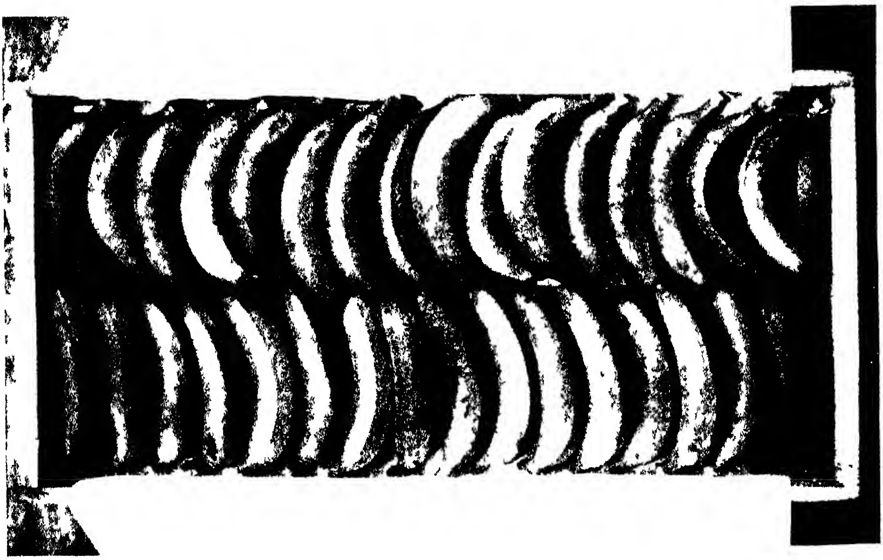

Fig. 1.—Method of packing bottom layer of Special

PLATE V.

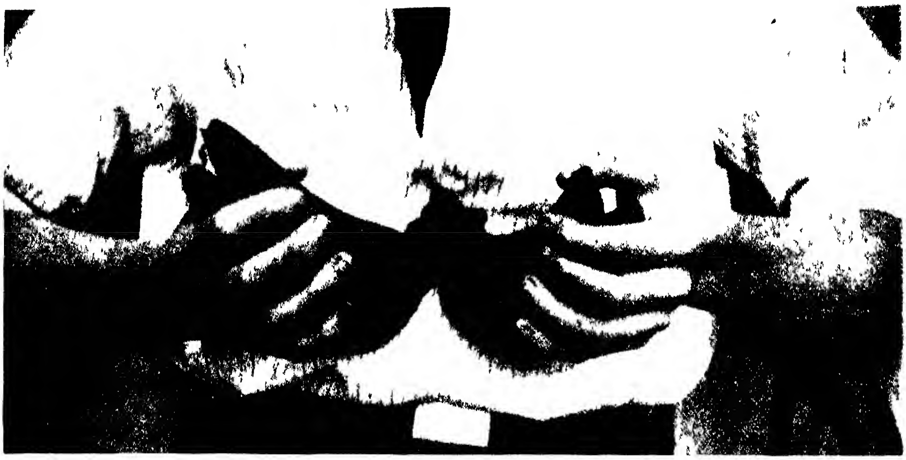

FIG. 22.—Correct method of breaking hands of Bananas.

FIG. 23.—Wrong method of breaking hands.

The article is illustrated by excellent photographs (Plate IV, figs. 20,21; Plate V, figs. 22-23) and contains detailed instructious on the handling of bananas, from the time the fruit is harvested until it is graded and packed for the market. W. S. G.

16. Refrigeration of Mangoes.

HIGGINS, J. E. and PUNZALAN, E. S. *Philippine Agriculturist*, Vol. XIII, No. 10, pp. 443-449. Los Baños, Laguna, 1925.

Comparatively little systematic work has been done with respect to the refrigeration of tropical fruits. The object of the author's experiments was to make preliminary trials to indicate the best temperatures and conditions for later and more extensive experiments with mangoes. The work was carried out on fruit of the Carabao and Pico varieties, the former being one of the finest varieties known.

The fruits used in the experiments were all very similar as regards maturity, except that a few showed a slight loss of green colour; all were hard.

The experiments indicate that sound, green and hard, but fully mature Carabao mangoes, retain their condition under cold storage at about 36° F. for a period of 18 days or more, but not so long as 35 days. The fruit was in no way injured, and in flavour, texture and colour was equal to fruit which has not been stored. W. S. G.

17. The Howard Method for Detecting Spoilage in Preserved Strawberries and Blackberries.

NEEDHAM G. H. and FELLERS C. R. (Department of Food Preservation, University of Washington). *Journal of the Association of Official Agricultural Chemists*, Vol. VIII, No. 3, pp. 313-327, fig. Washington, D. C, 1925.

The enumeration of moulds, ferments and spores by the HOWARD method may also be applied to strawberry and blackberry preserves. These products cannot be preserved more than a day before proceeding to treat them. The presence of many moulds, determined by the HOWARD method, indicates a high percentage of musty or spoilt fruits; th presence of many ferments indicates that there are many spoilt and fermented fruits. Both deteriorations are observed contemporaneously.

The highest values for moulds are obtained when the pulp only is used; the juice contains fewer, and the mixture of juice and pulp still less. For the enumeration, the whole of the contents of the jar under examination should be utilized.

In strawberry jellies there is always a very small number of moulds, ferments and spores, whatever the condition of the product used. Strawberry or blackberry preserve on the other hand always contains a greater number of moulds than the raw product. Ferments show but few variations, and rather tend to decrease.

The presence of soft or over-ripe fruits, apparently unspoilt, gives a different value for moulds, especially in the case of blackberries. A. F.

Animal products.

18 **The Rape-Colewort Taste in Milk.**

ORLA JENSEN. Sur le goût de chou-navet dans le lait. *Le Lait*, Year V, Vol. V, No. 41, pp. 30-33. Paris, 1925.

The rape-colewort, or mustard taste, is due to the agency of certain species of bacteria capable of separating the mustard essence contained in the parent substance (a glucoside) met with more or less abundantly in all the crucifers.

The parent substance passes from the cow's udder directly into the milk and acts as a poison on young children. Nevertheless it is not the parent substance as such which imparts the flavour to the milk; there must have been a separation of the mustard oil. In spoilt turnips, there may have been a part of this liberated substance, but fresh milk rarely has this disagreable taste, which only develops gradually through bacterial influence.

The active bacteria originate either from the water used for washing and rinsing the buckets and vessels, or from cow's dung. The utmost cleanliness should be observed in milking therefore, and if in spite of this the milk has the rape-colewort flavour, a bacteriological examination of the water should be made.

In a test made by the author, it was shown that the bacteria which caused the rape-colewort flavour were liquefying, non-sporing, bacteria, of aqueous origin.

The rape-colewort flavour may also be developed in butter: butter made from sterilised cream and inoculated with these liquefying bacteria, smelt rancid after a time, and after the fat had been removed by filtering, a decided decomposition could be observed.

It is important, therefore, that dairies should have a bacterial examination made of the water they use; if this water contains an appreciable number of liquefying bacteria it must be sterilised before coming into contact with pasteurised cream and butter. P. D.

19 **The Influence of Different Methods of Pasteurisation by Heating on the Digestibility of the Albumenoid and Mineral Constituents of Milk.**

TERROINE, E. F (Professor at the University and Director of the Institute of General Physiology of the Faculty of Science at Strassburg) and SPINDLER, H Influence des divers procédé des pasteurisation par chauffage sur la digestibilité des constituants albuminoïdes et minéraux du Lait. *Le Lait*, Year V, No. 43, pp. 241-256, 6 figs. bibliography. Lyons, 1925.

It is important that only milk should be delivered for public consumption which is free from injurious micro-organisms, but its composition and properties at the time of secretion should have been modified as little as possible. These two desiderata appear to be contradictory, for to des-

troy the micro-organisms, the best method is to heat the milk, thus risking modification of its composition, the impairing of its physical structure if not the composition even of its constituents.

The authors have made a comparative study of the influence of low and high temperature pasteurisation, and the STASSANO process.

Cow's milk, sometimes fresh, sometimes subjected to the various processes of pasteurisation under examination, was administered to young pigs of the same age and weight (8-10 kg. when the tests commenced), during the growth period. The quantity of milk given is calculated on the basis of its caloric energy, at the rate of 150 calories per kg. of live weight. The total ration is distributed in three parts, at 8, 13 and 18 o' clock, the milk is heated to 37° C. in a double boiler, and the trough in which it is fed is taken away as soon as the animal has consumed all the milk.

The animals are placed in a special pen which allows the urine and faeces to be removed separately.

In a first series of tests, various animals were compared with one another, and in a second the comparisons were made on the same animal receiving a different milk for each test period, lasting a week.

Every day, both on the milk taken in and on the various portions of faeces collected, the total nitrogen was estimated by the Kjehldahl method, and the ash by incineration in a muffle furnace after desiccation; the results enabled the coefficients of digestibility to be calculated.

Every day a mixed cow's milk was utilised. The first part is given in its natural state; three other portions are treated respectively by one of the following processes:

Low temperature pasteurisation: heating to 63°C. for 25 minutes, with mechanical stirring, then cooling;

High temperature pasteurisation: heating to 95°C. for one or two minutes, then cooling;

STASSANO *process*: heating to 75°C. for 4 ar 5 seconds, the milk flowing out in a thin layer continuously, then cooling.

The results of the tabulated tests enable the following conclusions to be drawn:

(1) Milk, fresh or subjected to heating by the high temperature pasteurisation process, the low, or the STASSANO gave identical coefficients of digestive utilisation of nitrogenous substances and ash.

(2) The values obtained for the coefficients of digestibility of the proteins of cow's milk by the pig are exactly the same as those previously observed by various authors for the digestion of cow's or human milk by children. The specific origin therefore does not entail any difference in digestibility.

(3) Even with a very young animal of rapid growth, feeding with milk alone only allows a poor assimilation of nitrogen: taken at the rate of 150 calories per kg. by young pigs of 8 kgs. weight, the milk only leaves in the organism 50 % of the proteins it contains.

Such method of feeding therefore entails a considerable waste of nitrogen.

P. D.

PLANT DISEASES AND PESTS

Plant Parasites.

20. The New General Supplement to SACCARDO's *Sylloge Fungorum*.

SACCARDO P. A. Sylloge Fungorum omnium hucusque cognitorum, Vol. XXIII. Supplementum universale, Part X: *Basidiomycetae*. Curante A. TROTTER (Collab. P. A. and Dominicus SACCARDO, G. B. TRAVERSO, A. TROTTER). One vol., large 8°, XXXII, pp. 1026. Avellino, Pergola, 1925.

Twelve years after the appearance of the last volume of the *Sylloge Fungorum omnium hucusque cognitorum* the continuation has been realised of this very important work for mycological and phytopathological studies, of which the Library of the International Institute of Agriculture has the privilege of holding the copy that P. A. SACCARDO had while living, supplementing it with important printed documents and enriching it with frequent annotations in his own hand.

In fact, through Prof. A. TROTTER, who has added to the material already collected for the purpose by P. A. SACCARDO, in collaboration with Professors D. SACCARDO and G. B. TRAVERSO, the 23rd Volume of the *Sylloge* has now been published. This Volume also forms the tenth part of the *Supplementum universale* to that work, and, as such, includes the diagnosis, made public during the decade 1911-1920, of the Basidiomycetes described in various parts of the world. The fungi discovered in the same decade, but belonging to other taxinomycetic groups, will be registered in Vols. XXIV-XXV of the *Sylloge*, forming respectively parts XI-XII of the *Supplementum universale*, the printing of which will be carried out without delay.

The volume which appeared in 1925 deals with Basidiomycetes, thus classified: *Hymenomycetae* (*Agaricaceae, Polyporaceae, Hydnaceae, Clavariaceae, Thelephoraceae, Tremellaceae*); *Gasteromycetes* (*Phallaceae, Nidulariaceae, Lycoperdaceae, Hymenogastraceae*); *Ustilaginaceae* (*Ustilagineae, Tilletieae*); *Uredineae* (*Pucciniaceae, Melampsoraceae, Cronartiaceae, Coleosporiaceae, Uredinaceae inferiores*).

The total number of species here enumerated is 3314.

The descriptive part of the volume is preceded by a biography of the author of the *Sylloge*, with his portrait and the complete Saccardian bibliography, comprising 238 works, of which 125 are on Mycology, Phytopathology and Cryptogamic nomenclature; the remainder relate to other branches of Botany and the Natural Scuences.

The volume concludes with an index of the fungi described therein, arranged according to their respective hosts, an alphabetical index of the genera and another of the species treated in the volume itself.

G. T.

21. **The Effect of X-Rays on "Plant Cancer" (*Bacterium tumefaciens*) and on Normal Plant Growth.**

RIVERA V. Il problema del cancro e quello delle infezioni microbiche nel mondo vegetale. *Memorie del Laboratorio di Botanica della R. Università di Bari*, N° 1, 23 pp. Bari, 1925.

Hyperplasiae caused by *Bacterium tumefaciens* on *Pelargonium zonale* and obtained by the author at Bari by inoculating with the agent of "plant cancer" taken from a pure culture, were afterwards subjected by him to the action of the X-Rays. This means has been employed in the investigation of cancer in man and animals of which recent investigators have shown the analogy with "plant cancer".

The author opens by saying that immediately after a first treatment the growth of the hyperplasiae themselves was stopped, and they soon became smaller until they almost reached vanishing point.

Under the microscope, in the hyperplasiae treated, the cell walls generally in the zone formed of small cells appeared to be torn and disrupted, as though the cells had burst.

The author also observed that, after carrying out the operation in the same conditions as for the *Bact tumefaciens* test, the action of the X-Rays clearly prevented the normal growth in pots of bean plants, whereas it caused no apparent changes in maize plants contained in the same pot.

G. T.

22 **The "Fogging" or "Blackening" of the Leaves of the Sugar-Beet (*Cercospora beticola*) in Italy, during 1924.**

MORI G. La Cercospora della barbabietola da zucchero nel 1924. 61 pp., 15 figs. Stabilimento tipo-litografico Marcisi e C., Genoa, 1925.

During 1924, especially in the valley of the Po, the attack of *Cercospora beticola* Sacc. on sugar beet was so serious as to cause very great loss to farmers and sugar manufacturers.

In the above-mentioned area the fungus showed itself as usual about the end of June, became more injurious during the two succeeding months and attacked chiefly the older, outside leaves of the host. Beet plants growing too far apart, and especially isolated plants, were more easily subject to infection and were more damaged.

The attack of the parasite on the leaf was accompanied by other phenomena, such as excessive conical elongation, of the collars (such deformations, more frequent in 1924 than formerly, were specially noticed on sparse and isolated plants); formation in the upper part of the root, at the point of insertion of the first leaves, of cavities, sometimes of considerable size; unusual growth (small roots mixed with large, very large and even monstrous roots, short stumpy roots, very much split up at the base); alterations in the arrangement of the tissues of the root and in its sugar content, etc. The experimental observations made in 1924 showed the efficiency for preventive control of the fungus, of the use of copper solutions applied by powerful sprayers.

Such treatment increases the production both in weight and in percentage of sugar. Damage by the parasite may, according to the writer, be reduced :

(1) By increasing the number of the beet plants per square metre.

(2) By avoiding isolated roots and plants ; beets should be uniformly spaced over the ground.

(3) By selecting varieties of beet most resistant to the fungus.

(4) By scientific manuring. G. T.

Animal Parasites.

23. **The Hyphomycete *Spicaria canadensis* n. sp. a Natural Enemy of the Macrolepidoptera *Stilpnotia salicis*, in Canada.**

VUILLEMIN P. A. New Fungus Disease of the Satin Moth Larva. *The Canadian Entomologist ;* Vol. LVII, N°. 4. pp. 97-99, 7 figs. Orillia, 1925.

In Western Canada, and especially in British Columbia, the larvae and chrysalids of the injurious Microlepidopteron *Stilpnotia salicis* L. (1) are attacked by a parasitic hyphomycete which the author considers to be a species new to science and describes under the name of *Spicaria canadensis*. G. T.

24. ***Aphidius* sp., a Parasitic Hymenopteron on the "Black Aphis" of the Peach *(Anuraphis persicae)*, in France.**

GAUTIER Cl. and BONNAMOUR S Un *Aphidius* (HYM BRACONIDAE) parasite du Puceron du Pêcher. *Bulletin de la Société entemologique de France*, *N°* 7, p. 127. Paris, 1925.

In three localities of the Rhone Department — at Monplaisir and Saint-Cenis — Laval during 1923, and at Chatillon d'Azergues the following year, the " black aphis " of the peach (*Anuraphis persicae*) which was very abundant, was attacked and almost completely destroyed by a Hymenopteron Braconid parasite not yet definitely determined, but which appears to be very closely related to *Aphidius cardui* Marsh. G. T.

25. ***Argyrophylax inconspicua* and *Masycera sylvatica*, Parasitic Diptera respectively of Lepidoptera *Graëllsia isabellae galliaegloria* and *Celerio Vespertillo*, in France.**

CLEU H. Diptères parasites des chenilles de Graëllsia Galliaegloria Obthr. et de Celerio Vespertilio Esp. *Bulletin de la Société entomologique de France*, N° 7, pp. 126-127. Paris, 1925.

The Diptera *Argyrophylax inconspicua* Meig. (*A. bimaculata* Hartig) and *Masicera sylvatica* Fall. are reported for the first time as parasites respectively of the larvae of *Graëllsia isabellae galliaegloria* Obthr. and *Celerio verspertilio* Esp.

(1) Cf. *R.* May 1921, No 585, and August 1921 No. 877. (*Ed.*)

Both the Lepidoptera hosts from which the Diptera emerged after breeding, were collected at La Bessee-sur-Durance, the first on the Scotch pine and the second on *Epilobium rosmarinifolium*. G. T.

26. *Elasmognathus* sp., a Rhynchote injurious to the Pepper Plant in Cambodia.

BATHELIER, J. Observations sur un insecte parasite du poivrier. *Bulletin économique de l'Indochine*, New Series, 28th year, No. 170, pp. 62-72, 1 pl. Hanoi, 1925.

The author reports an investigation by him on an insect injurious to pepper plants in the Kampot region of Cambodia. It is a Rhyncote belonging to the family of Tingidides and the *Elasmognathus* Fieber genus, very closely related to *E. nepalensis* Distant, of which it may even be merely a variety. A different species of the same genus is also injurious to the pepper plant in India.

If a pepper plant be examined while in flower, that is in the period from February to October, it will be noticed that the flowers have become covered with *Elasmognathus*, both adults and those in a more or less advanced larval state. The larvae are more numerous than the adults, which seems to indicate that the insect lives longer in the imperfect than in the imago form.

The young and winged individuals of the Rhyncote perforate the peduncles of the flowers, suck the sap and cause the drying of the fruit. The damage thus done is enormous ; the Chinese pepper growers estimate that in spite of the nicotine treatment which they apply, they still lose about $\frac{1}{3}$ of the crop. This Rhyncote is abundant while flowering continues. In October it becomes more and more rare, and during the whole of the dry season only a few active adults are to be found.

As soon as the flowers appear again, in February, individual insects are met with in all stages of development. Their number gradually increases, and from March the maximum quantity is reproduced.

Apparently they deposit their eggs on the flowers themselves ; the flowers constitute their preferred food, and the spread of the species is dependent on the quantity of flowers available. The species survives from year to year through the rare adults which take no food in the absence of flowers, or draw the sap from the leaves which are always available during this time they are apparently unable to reproduce themselves.

The planters use as an insecticide, a decoction of dry tobacco stems and a Cambodian Dioscoracea, the root of which contains an alkaloid allied to strychinine.

The author advises the use of either of the following mixtures :

(1) 3 kg. of syrupy tobacco extract, 4 litres of stick paste (100 gms. of wheat flour per litre), or 3 kg. of soft soap to 130 litres of water ;

(2) 4 kg. of tobacco leaf ribs boiled in 10 litres of water, left to stand for 24 hours, and then strained, 2 kg. of soft soap dissolved in 4 litres of hot water are then added, and the solution diluted to 100 litres.

The treatment consists in spraying sufficiently often to prevent the reproduction of the insects, which, protected by the egg envelope, have escaped the former spraying. The pepper plants therefore should be treated every week.

It would be well to interpolate, between the nicotine sprayings, sprayings with dry substances which also act as contact poisons. These sprayings should be done with sprayers of medium power.

The advantage of these substances is that they penetrate the body of the insect by the open spiracles, which can no longer rid itself of them It perceives the danger only when it is too late for defence.

Only tests methodically carried out could show what insecticide powder has the most energetic action. The author indicates the following as powders which should be tested : pyrethrum, tobacco, and arseniate of lime.

It would be preferable to carry out these dry sprayings before the liquid spraying has completely dried, one day after for instance. The slight moisture then remaining on the leaves would retain a little of the powder without dissolving it, and prevent its being carried off by the wind.

Dried tobacco could be used, ground as finely as possible. This impalpable powder would serve for the dry sprayings, which should be thinly distributed as an almost imperceptible dusting suffices. The coarser residues would be weighed and would serve to make up the mixture of which the formula is given above.

The two applications should be continued at longer intervals, every month for instance, during the dry season. One month before the appearance of the first flowers they should again be made every week, in order to destroy individual insects, which preserve the species during the unfavourable season, and thus to delay their swarming at the moment of flowering. P. C.

27. ***Engytatus notatus* and *E. geniculatus*, Rhyncotes injurious to Tobacco in Brazil.**

MOREIRA C. Os percevejos capsideos do fumo no Brasil. *Boletim do Ministerio da Agricultura, Industria e Commercio,* Vol. XIII, No. 7, pp. 85-91, 4 fig. Rio de Janeiro, 1925.

Engytatus notatus (Dist.) and *E. geniculatus* Rent., Rhyncotes of the Capsidae family, are two of the most serious enemies of the tobacco plant in Brazil.

These insects collect in great numbers on the host plant, principally on the under sides of the leaves. Their punctures cause damage to the tissue of the leaves, which consequently appear spotted and wither prematurely. In addition, the leaves are disfigured by the excrements which the insects deposit on them, so that the product, even if it does not become quite useless, loses a great deal of its value.

The life of the two Rhyncotes has a total duration of about twenty days, but their generations succeed each other uninterruptedly ; in a short time a whole plantation is infected.

They develop considerably during the hottest and driest time of the year, and decrease in numbers according as the temperature falls and rain becomes more abundant.

Biological observations made regarding *E. notatus* are given ; the biology of *E. geniculatus* is almost identical with that of the former species. The writer recommends the protection of the tobacco seedlings against both Rhyncotes by means of cages covered with wire gauge of mesh not larger than one millimetre. After transplanting, the young plants should also be protected until they have attained a height of about thirty centimetres, by means of spraying with emulsions of ordinary hard soap, crude kerosine oil and tobacco extract The emulsion should not contain more than two per cent. of kerosene oil. With this insecticide a mortality of seventy per cent of the insects sprayed is obtained

Since the winged insects — more vulnerable than the larvae – hatch out every nine days, the treatment should be repeated every ten days, so as to spray the winged insects, until the parasites are completely destroyed.

The plants treated with the above emulsion, after a few days, especially if rain occurs, will no longer smell of kerosine, so that the author considers that the treatment in question should not be prejudicial to the quality of tobacco. G. T

28 **Observation and Tests regarding the *Tropinota hirta* Coleopteron, Injurious to Grasses and Trees in the Campania. (Italy).**

VIGGIANI G. Alcune notizie sulla morfologia e sulla biologia della *Tropinota hirta* con speciale riguardo ai danni da essa recati alle coltivazioni erbacee ed arboree *Bollettino della Società dei Naturalisti in Napoli*, Vol. XXXVII (ser. II, Vol. XVII), Year XXXIX (1925), pp. 28-53, 2 plates. Naples, 1925.

Results of the observations and tests made from June 1922 to June 1924, regarding the morphology and biology of the adult and larva of the Curculionid *Tropinota hirta* Poda Coleopteron, which have developed in great numbers for some years in vast tracts of the Campania, causing serious injury to the grass and tree crops.

The mouth apparatus of this insect is not typically masticatory, it is adapted to a system of feeding having an essential basis of pollen, which can be licked up without being masticated

Investigations made on some thousands of flowers belonging to 24 different botanical families — among which should be mentioned Leguminoseae, Rosaceae, Compositae, Crociferae, Mirtaceae, Papaveraceae, Cariophyllaceae, Rutaceae and Graminae — have led the author to the conclusion that the damage caused to the flowers by *Tr. hirta* are generally indirect, i. e. caused by the strong claws and considerable weight of the body of the Coleopteron when in search of pollen and nectar, the direct damage, i. e. the feeding on pollen, being of no importance whatever, from the fact that every anther contains sufficient pollen to fertilise a great number of flowers. The extent of the damage is in close relation to the number of individuals of *Tropinota* present in a given region, the greater or lesser abundance

[28]

of these will cause more or less serious damage to the crops. Plants cultivated for their flowers are generally hindered by an excessively large number of Coleoptera. Neither the direct observations nor the laboratory tests made by the author proved that *Tr. hirta* gnawed especially the pistil of the flowers visited (the broad bean, for instance).

The author observed that the Coleopteron, when it first appears, prefers low ground, whence it passes, as the season is advances, to the hills and mountains ; the insect abounds in regions where the spontaneous flora is rich and cultivation intensive, whereas it is scarce in regions poor in flora and backward in agriculture ; heat is favourable to the development of the larva and still more to the activity of the adult, also to the propagation of the species.

As regards the natural enemies of the Coleopteron in the Campania, some of its pupae have been found invaded by undetermined fungi ; often, under the elitra of *Tr. hirta,* the presence of Acari have been observed, which however do not seem to injure their host.

Up to the present, the most effective artificial means of controlling this insect is to collect the adults, especially when they first make their appearance.

Hedges of hawthorn, clumps of elders, etc , planted all round the fruit ground, by attracting to their flowers the individuals of *Tropinota,* free the fruit trees from the latter ; the same may be said, in the case of sowings of rape, cabbages and mustard planted between the rows. The collecting of the adults should always be done a second time, when there will be found a large number of *Tropinota* massed on a few flowers

In the author's opinion it is not advisable to spray the flowers with poison solutions or with the ordinary insecticide powders. G. T.

20. *Acrobasis hebescella*, a Microlepidopteron Injurious to the *Hicoria Pecan*, in the United States.

GILL J. B. *United States Department of Agriculture, Department Bulletin* N° 1313, pp. 12, figs. 4, Washington D. C., 1925.

The results of a detailed investigation on the biology of *Acrobasis hebescella* Hulst, made at Monticello (Florida). Here, as at Thomasville (Georgia), this Microlepidopteron (fam Pyralidi) has, for about a decade, caused considerable loss to the growers of " pecan " (*Hicoria Pecan*). The insect, to which has been given the common name of " pecan nut casebores ", is known to cause serious injury to the same Juglandacea also in other districts of Georgia and in Texas, and has been reported in the States of New Jersey, Illinois, Wisconsin, Connecticut, Mississippi, Louisiana and Alabama, and seems to be gradually extending its sphere of destructive action.

Though both the oak and the pecan have been indicated as host plants of the Microlepidopteron, the author found it only on *H. Pecan.* It may be concluded, however, that it also attacks other species of the genus *Hicoria*

The grubs of *A. hebescella* may also injure both the tender shoots and the immature fruits by boring galleries therein. Those grubs which have

wintered near the bud, attack the young shoots at the beginning of Spring. Many of these, in consequence of such attack, fade and turn brown; others weakened by internal erosion, are broken off by the wind. Such injury, however is not very serious as compared with that caused by the grubs, especially of the first, but also of the second generation, which limit their attacks to the young green fruits.

Having described the various stages of development of the insect and its biology and habits, the author enumerates in the order of their importance the natural enemies obtained, by breeding, from *A. hebescella*. They are: *Exorista* (*Nemorilla*) *pyste* Walk., *Habrobracon variabilis* Cush., *Calliephialtes grapholithae* Cress., *Cremastus* (*Zaleptopygus*) sp. and *Angitia* sp.

The best method of control by artificial means is that of spraying with lead arsenate with the addition of lime solution. Three applications are advised: the first as soon as the fruits have formed; the second, a week or ten days later, the third, four to five weeks after the second spraying. The last may be omitted for economical reasons, but the first two are absolutely necessary. G. T.

CURRENT NOTICES

Legislative and Administrative Mearures.

30. **France: The Chambers of Agriculture.** - The regulations for the application of the Law of 3 January 1924 on the Chambers of Agriculture were published in the *Journal Officiel* of 26 March 1925.

31. **France: Provisions Guaranteeing the Declaration of Origin of Roquefort Cheese.** - These are contained in a law of 26 July 1925, published in the *Journal Officiel* of 30 July. The denomination "Roquefort" is only to be allowed in the case of cheese which: (*a*) has been prepared and manufactured exclusively with sheep's milk, (*b*) has been manufactured and refined in strict and faithful conformity with local usages, both in regard to the place of production and the method employed. The zone of production of the sheep's milk which enters into the composition of the "Roquefort" naturally remains limited to the centres now existing in France, as well as to those localities in France proper which present the same characteristics as these centres, both as regards breeds of sheep, pasture and climate

32. **Italy: Measures in regard to the Cultivation of Cereals.** — With the object of encouraging the growing of cereals in Italy to the utmost possible extent, a number of enactments have been issued which taken as a whole make systematic provision for the necessary organisation and the technical and financial requirements in view of the "cereal campaign" (*battaglia del grano*). In the first place a Permanent Committee for Cereals has been set up, and the customs duties on wheat, the minor cereals and their derived products have been re-instituted.

In order to encourage the diffusion of motor ploughing, measures have been passed abolishing the duty on petrol if supplied to a farmer, at a sacrifice of 5,000,000 liras yearly; and increasing to 40,000,000 liras the sum set aside to meet the applications for loans for the purchase of special heavy implements and machinery designed for preparing land for ploughing in areas not previously considered suitable for field crops In addition, a further allocation of 3,000,000 liras annually has been made for contributions, up to one fourth, towards the expense of purchasing similar appliances and for premiums payable to persons undertaking the breaking up of land

A further development of the work of the *Cattedre Ambulanti di agricoltura* in the direction of propaganda and technical assistance for cereal cultivation is contemplated and for this purpose the funds allocated to these bodies are

increased by another three million and a half liras, the total allocation thus amounting to 7,000,000 liras. In addition, another 7 million liras are being set aside yearly for the establishment in each commune of the Kingdom, at the State expense, of experimental fields for wheat growing on methods suitable to the district, and a further 4,000,000 are placed each year at the disposal of the Experimental Agricultural Institutes for grain cultivation. Five millions have been assigned to the work of promoting the more general use of selected seeds: the State contributing up to 50 per cent to the establishment of consortia and associations undertaking the production and the distribution of such seeds.

In addition, Provincial Grain Commissions have been established and have been assigned the funds required for carrying out an intensive propaganda.

Provision is made for loans for working capital, and the agricultural credit institutions, which owe their existence to special laws, have been empowered to expend sufficient funds to carry out an effective propaganda scheme for cereal cultivation, and for this purpose it has been arranged to make loans to the value of 120,000,000 liras.

Steps have also been taken to encourage the construction of grain warehouses, following the procedure as to loans sanctioned by other decree-laws on agricultural land credit (*Gazzetta Ufficiale*, 18, 24 and 31 July, 8 and 9 August, 1925)

33. **Italy: Enquiry into Cultivation of the Opium Poppy.** — A Committee of the Ministry has been appointed on the proposal of the Department of Public Health for enquiry and for the preparation of the rules under which cultivation of this plant may be carried on

34. **France (Morocco): Destruction of Caterpillars.** — This is rendered obligatory by the Dahir of 23 May 1925 (*B. O.* No. 660, 16 June 1925).

35. **Mexico: Regulations for the Introduction of Live Stock and Animal Products.** — These are contained in a Decree of 11 May 1925. (*Diario oficial*, 23 May 1925).

36. **Uruguay: Agricultural Legislation.** — The laws, decrees and regulations on the protection of agriculture (*Defensa Agricola*) are under revision for recasting, amplifying or amending as required, now that the service have been amalgamated to form the present Department of Agronomy This Departement includes the following Sections among others: Development and Protection of Agriculture (*Fomento y Defensa Agricola*), Agricultural Statistical Economy (*Economia Estadistica Agraria*); Information and Education (*Informacion y Enseñanza*), Forestry Section (*Seccion Forestal*); Laboratory (*Laboratorio*).

Experiment Stations and Agricultural Instruction.

37 **Germany: Soil Investigations.** — Research Associations (*Versucheringe*) to the number of more than 300 have been formed in Germany. Their object is twofold: on one hand to give technical advice to the individual holders as to cultivation of their land, on the other to draw conclusions of a general nature from the observations made by individuals Courses of instruction are held for members of these associations. The course

held at Halle in June 1924 dealt with the application of laboratory methods to field experiments, and six lectures with discussion were held respectively on the organisation of field experiments (ROEMER), technical methods in fertiliser tests (MITSCHERLICH), ascertainment of the best adapted species (SCHARNAGEL), seed testing (REMY), on the estimation of results from experiments (OPITZ) and on practical experience (KRAMER)

(*Deutsche Landwirtschafts - Gesellschaft* Anleitung fur Versucheringe. Collezione . "*Anleitungen fur den praktischen Landwirt* One Volume, 16mo of 114 pages Deutsche Landwirtschafts Gesellschaft, Berlin, 1925).

38 **Germany: Field Experiments.** — T ROEMER, in a special study, gives an outline of the method of organising field experiments, followed by a historical sketch, in this connection importance attaches to the foundation of the Research Associations under the direction of a qualified agricultural expert To secure any result, however, the experiments must be carried out with great precision, and the author gives valuable advice on this point The most interesting part of the book is the discussion of the errors and mistake that may be made in the course of the experiments and so falsify the results. mistakes as to the form of the plots, their situation and size, in the sowings, the gathering of crops, etc In the working out of the results too it is essential to follow the precise rules of statistical calculation described by the author, who gives in addition practical directions as to the general method Account has been taken of the important work recently done on this subject by Russian investigators (ROEMER T *Der Feldversuch* Eine kritische Studie auf naturwissenschaftlich- mathematischer Grundlage Second edition One volume, octavo 132 pp bibliography, one map *Deutsche Landwirtschafts-Gesellschaft*, Berlin, 1925)

39. **Germany: Sugar-Beet Experiments** – Various German Agricultural Science Institutes have become members of an organization for collective and comparative experiments on the varieties of cultivated beets in Germany, towards which the Ministry of Food and Agriculture has made a grant of 50,000 marks These institutions included the Institutes of Bornburg, Bonn, Breslau, Halle, Hohenheim, Landsberg and Rostock The experiments are to include 10 varieties of German beets and seven foreign varieties, but for 1925 it has been decided not to submit to experiment more than nine German and one Dutch variety, as it was too late to obtain from abroad, on favourable terms, seed samples for experimental cultivation

The experiments are to be continued for a period of about ten years

40. **Germany: Object Lessons in Plant Pathology by the use of Clay Models** — Attention is called to the clay modelling work of the German Modelling Society (*Deutsche Hochbild-Gesellschaft*) at Munich, Reinbergerstrasse 5, which has been favourably noticed by all the German technical press (agricultural, special phytopathological and educational journals, etc) They are executed with greatest possible exactitude and their value and the quality of their execution received recognition at the Educational Exhibition (*Mostra del Materiale Esposizione Didattica Scolastica*), held at Florence in 1925 (Communicated to the International Institute of Agriculture)

41. **Austria : Twenty-fifth Anniversary of the Higher Forestry of Bruck-on-Mur.** — This celebration was held on 25 May 1925. The first move towards the establishment of this Institute dates back to the tenth General Meeting of the Forestry Association of Styria, held on 12 July 1892, Dr. RUDOLF JUGOWIZ formerly professor at the Higher Forestry Institute of Weisskirchen, Moravia was appointed as director at the time of its actual foundation (1900). (*Höhere Forstlehranstalt*) (*Forst- und Jagd-Zeitung*, Year 43, No. 29 Vienna, 1925).

42. **Brazil : Agricultural Experiment and Instruction in the State of Bahia.** — The following particulars of the Experiment Farm at Ondina and the Bahia Agricultural School form part of the "Message" (*Mensagem*) presented to the Legislative Assembly on 7 April 1926 by the Governor of the State of Bahia, Dr J DE GOÉS CALMON.

The Ondina experiment and demonstration farm (*Campo de Experiencias e Demonstração*) has carried on work with the object of introducing into Bahia crops not previously known, and giving theoretical and practical instruction in the use of farm machinery. A well equipped meteorological section is attached and a laboratory and museum, under the direction of the entomologist and phytopatologist, Dr G BONDAR. This laboratory publishes its own bulletin As the cultivable area of the experimental farm is too small there is a scheme for enlarging it by acquiring a neighbouring "fazenda" and adapting it for growing hay or fruit, flowers and seeds.

Attention will be given to the further development of the school of agriculture. Although there are 300 hectares of land belonging to the school, it has so far no demonstration farm ; it is however to make the proper provision

The school has a well arranged library of about 5000 volumes and a well-equipped museum and premises (*Mensagem apresentada pelo Exm Sr.* Dr. FRANCISCO MARQUES DE GOÉS CALMON, *governador do Estado de Bahia a Assembléa Geral Legislativa, por occasião da abertura de la reunião ordinaria da 18ª legislatura em 7 de abril de 1925* Bahia, 1925).

43. **Brazil : The activities of the Experimental Station of Piracicaba.** — A report has been published of the work of the cotton department of this Experimental Station in 1925. Valuable work is carried on in the cultivation of numerous varieties of cotton with a view to selection and specially those which have already been proved to be long staple, and productive types ("Delphos 6012", "Meado", "Sea Island", "Express", "Webber Delta Type", "Webber 49", "Delphos 631", "Star", "Mebane", "Selecção No. 1",, "Selecção No. 2" "Rowdon"). The plants on the Station are numbered according to the instructions recommended in the United States by the Department of Agriculture.

The report in question refers to various experimental investigations of fertilisers, rotation, etc., carried on at the Station by the Cotton Department. Every precaution has been taken for isolating the different cultivation plots with a view to preventing any spontaneous cross breeding. (*Boletim de Ministerio da Agricultura, Industria e Commercio*)

44. **Brazil : The Museum of the Pomological Station of Deodore.** — A detailed scheme is described for the organization of the Museum of this

important Brazilian Station, containing the following sections: Soil and fertilisers — Plant genetics — Plantation — Irrigation — Pruning — Plant diseases and pests — Fruit picking — Preserving and packing — Industrial products — Photographic records and national and foreign fruit growing. (*Boletim do Ministerio da Agricultura, Industria e Commercio* (a. XIV). Rio de Janeiro, 1925).

45. **Denmark: Organisation of the National Experiment Institute for Plant Cultivation.** — On the occasion of the twenty-fifth year of the foundation of the Danish State Office for plant cultivation, the history of the organisation of this Institute is given by the author. The story goes back to 1860, when the first experiments were undertaken to establish comparisons between manuring with stable manure and with chemical fertilisers. Special prominence is given to the work of P NIELSEN who up to the age of 27 was working in a factory, and studying to take the elementary teachers' certificate. In his space time he devoted himself to botanical studies and to experiments on plant growing, on seed mixtures for meadows, on plant diseases and arrived at important practical conclusions He received grants in aid from the State and by degrees his work developed into this institution for practical and scientific research, which takes so important a place in the progress of agriculture in Denmark, and which is so liberally assisted by the State The list of 172 reports and 106 communications is evidence of the active work of this valuable institution.

(LARSEN H C. Statens Forsogsvirksomhed i Plantekultur, dens Organisation og Administration *Tidsskrift for Planteavl*, Vol 30, Part I, with 62 illustrations and a map Pfr. R. o. No 780, 1924)

46. **United States: The Work and Position of the Agricultural Experimental Stations in 1923.** – This information is contained in a complete report published by the Office of Experiment Stations of the U. S. A. Department of Agriculture. Attached to the report is a complete list of the publications issued at the various stations during 1923 (Botany, Chemistry, Bacteriology, Meteorology, Soil, Fertilisers, General agricultural work, Horticulture, Forestry, Phytopathology, Entomology, Zoology, Animal husbandry and periodicals) For the fiscal year 1922-23, 920 in all publications appeared relating to the various branches of agricultural science (E W ALLEN, W. H. BEAL and E. R FLINT, Work and Expenditure of the Agricultural Experiment Stations, 1923. *United States Department of Agriculture, Office of Experiment Station*, Washington, D C., 1925).

47. **United States: The Arnold Arboretum Library, Jamaica Plain, Mass.** — This institution which is affiliated to Harvard University possesses a specially fine collection of incunabula and generally of early books on systematic botany. The library was begun in 1873 and now contains 35,471 complete volumes and 8000 pamphlets. The collection of Pre-Linnean books (dating from before 1737) contains very valuable bibliographical treasures, including twenty-five books published in the fifteenth century, among which are, APULEIUS PLATONICUS, *Herbarium* (1481 ?); BARBARO, *Castagiones* (1492-93); BARTHOLEMAEUS ANGLICUS, *De proprietatibus rerum* (1480-1491), *Libri de re rustica* (no date); CONRAD von HEGENBERG, *Buch der Natur* (1478), and works of PLINIUS Secundus, THEOPHRASTUS Eresios,

COLUMELLA, LUCRETIUS, VINCENTIUS BELLOVACENSIS, MATTHEUS SYLVATICUS, MACER FLORIDUS, etc.

The periodical section also contains rare editions; among these are DIETRICH's *Oekonomisch-botanisches Garten Journal* in six volumes (1795-1805) almost unknown in America, the *Annales de l'Institut horticole de Fromont* (1829-34); LANDRETH's *Floral Magazine and Botanical Repository* (1832-34); *L'Horticulteur Belge* in five volumes from 1833-1838, etc.

The collection of publications on conifers contains all the books which are known to have been published about these plants. and it may be added that the collection of conifers in the herbarium is probably the best in the world, only five or six species which grow on the mountains of New Guinea and on the Fiji Islands being now unrepresented

With the exception of twenty-five volumes written by members of the Staff and published by the Arboretum, this library which is now valued at about $ 1,000,000 has been presented by a few friends of the University. (*Bulletin of Popular Information, Arnold Arboretum, Harvard University*, Jamaica Plain, Mass, 1924)

48. **United States: Analyses of the New York Sugar Trade Laboratory.** – This laboratory has in 1924 analysed 10371 samples of raw sugar which are sold in New York on a polarimetric basis of 96°. The average polarimetric grading of the samples which came to the laboratory was 96.02, that is to say a rate very close to the commercial basis, which points to an improvement in the quality of the raw sugar in comparison with previous years (*Circulaire hebdomadaire du Comite Central des fabricants de Sucre de France*. Year 37, No 1834 Paris, 1925).

49 **France: Lectureship in the Veterinary Schools.** – For every subject taught in these schools a group of lectureships has been established open for competition by doctors in veterinary science. The subjects of instruction in these schools may be grouped as follows: chemistry and pharmacy; anatomy; physiology and therapeutics; agricultural science, botany and hygiene, general pathology and pathological anatomy; parasitology, medicine and surgery, animal pathology and obstetrics, microbic diseases and sanitary vigilance, zootechnics, manufacture and inspection of products of animal origin Only successful candidates in the group competition are admitted to the competition for the full title which is thrown open in the case of any lectureship being vacant. Meantime they assume the title of lecturer and pass on to take actual office each in his own subject as a vacancy occurs on the staff of his own school (*Journal Officiel*, 31 July 1925)

50. **France: Reestablishment of the Laboratory of Colonial Botany and Agriculture at the Paris Museum.** -- In the previous number of this Review mention was made of the fire which destroyed the greater part of the *Laboratoire de Botanique et Agriculture Coloniales* or *Laboratoire d'Agronomie Coloniale*, which is under the direction of the eminent research worker AUGUSTE CHEVALIER. The *Association française pour l'Avancement des Sciences* has sent out an appeal for funds for the replacement so far as possibleof the scientific treasures destroyed by the conflagration. Address, Dr. RIVET Secrétaire du Conseil de l'A. F. S. 28, rue Serpente, Paris IV, France.

51. **Algeria: Agricultural Apprenticeship.** — The Algerian Government with a view to familiarising residents who so desire, with local agricultural practice, decided some time ago to give encouragement to apprenticeship courses on the subjects, making use of the agricultural schools and local experiment stations. Among these institutions is prominent the *Institut Agricole d'Algérie*, at the Maison Carrée (Algiers) or at the *Ferme de Bertaux*, where in addition to the regular instruction with its corresponding equipment (laboratories, collections, libraries, etc), an Apprenticeship Course is carried on during the winter for drivers of farm machinery (*école d'apprentissage pour mécaniciens-conducteurs agricoles*) This course is worked in connection with the important Rural Engineering Station Other short courses are held at the *Institut agricole* in enology, grafting and pruning of vines and fruit trees, etc.

The pupils apprentices may be later sent on, when they wish to specialise in some branch of farming, to the institutions affiliated with the *Institut Agricole*, i. e. to the Botanical Station at the Maison Carrée, to the Hamma Experiment Garden, etc. Or they may be accepted at other institutions for agricultural instruction and experiment such as the Philippeville School of Agriculture which has 180 hectares of coast land under cultivation, the School of Agriculture of Sidi Bel Abbé with 105 hectares of plateau in the Oran district ; the farm experiment schools of Ain Temouchent in the department of Oran with 500 hectares of field crops, the Guelma Experiment School in the department of Constantine with 100 hectares of cereals, olives, stock rearing, etc., the Fermo-Branche Station, department of Oran, with cotton cultivation, cultivation of salt lands and fruit-growing), the Orleansville Station, Department of Algeria, where cotton is grown and irrigated crops, the Barral Station, department of Constantine, which specialises in cultivation and preparation of tobacco, the Tadmit pig breeding station in the Southern part of the Department of Algeria, the Stations of Ain Ben Noui and of El Arfiane, in the southern territories of Algeria. where palms grow and are cultivated (P. CHERVIN. Les Stages agricoles en Algérie. *La Vie Agricole et Rurale*, Year 14, Vol XXVI, N°. 10. Paris 1925)

52. **Great Britain: New Plant Pathological Laboratories at Rothamsted.** — The growing requirements in relation to the study of plant diseases and pests has necessitated further extension of the Rothamsted Station, and in June last, Lord BLEDISLOE, Secretary to the Ministry of Agriculture opened the new and extensive plant pathological laboratories (" *The Times* " June 22, 1925).

53. **Great Britain: Royal Botanic Gardens, Kew, 1924.** — The chief points of interest in the year's work carried on in the Gardens proper, the Herbarium or the Museums and Laboratory have usually been reviewed as part of the information contained in the *Kew Bulletin*, which has appeared since 1887. The main purpose of the Bulletin has always been to supply detailed notes on scientific investigation of economic products and plants, either conducted by the staff or brought under their notice and it has now become impossible to combine with these an adequate account of the general activities of the year. Hence it has been decided to issue this review of the work of the year as a separate Appendix. Some account is given of the improvements effected in the Gardens in the course of 1924 ; the usual lists of plants

presented and of plants and seeds distributed are included. It has been arranged that some of the exhibits of products from the British Empire Exibition at Wembley are to be housed permanently in the Museums Highly satisfactory progress has been made with the work in the Herbarium, where a geographical basis is now definitely adopted, so far as possible, for the collections, the interest of the Staff being in this way increased and breadened on ecological and phytogeographical lines (*Royal Botanic Gardens, Kew; Bulletin of Miscellaneous Information Appendix II*, 1925).

54. **Burma: The Burma Agricultural College and Research Institute, Mandalay,** was opened on December 2nd, 1924, by H. E. the Governor of Burma, Sir SPENCER HARCOURT BUTLER, G. C. I. E., K. C. S. I.

The building is a fine one and contains mycological, botanical, physical, entomological and chemical laboratories, a large museum, and library and reading rooms The College Farm extends over 600 acres. The College will be affiliated with Rangoon University (*Agricultural Journal of India*, Vol. XX, Part III, 1925).

55. **Science and Administration in East Africa.** In the Report of the East African Commission sent out by the British Government, the value of scientific guidance in the development of such countries is recognized. The Amani Institute, founded by Germany in 1902, was visited and the Commission strongly urges that it should be adequately maintained, and considers that the closing of three research farms in Kenya Colony in 1922-1923, on financial grounds, was a most unfortunate step. The Commission further recommends the development of the Nairobi Museum, and draws attention to the urgent need for Government co-operation in education The adoption of the Commissions proposals would lead to a great advance in scientific research in East Africa (*Nature*, Vol 115, No 2898 London, 1925).

56. **Italy: Experimental Stock Breeding Institute at Rome.** - This Institute was founded in December 1923 and regulations for its complete organisation were issued by Royal Decree, April 1925. The Scientific Headquarters are in Rome and the experimental farm on an Estate of its own and a station for animal prophylaxis has been attached

The essential objects of the Institute are the study and the solution of the scientific and practical problems which are involved in the rationing, and breeding of livestock with special reference to the stock breeding industry of Central Italy and more particularly of Latium The Institute is placed under the inspection of the Ministry of National Economy. (*Gazzetta Ufficiale*, 13 May 1925).

57. **Java: Applications of Statistical Method to Experiments in Sugar Cane Cultivation.** — The author, Mr. VAN BREMEN, of the Sugar Experiment Station in Java applies to the enquiry into the production of sugar cane on experimental fields the laws and the formulae of statistical method, so as to ascertain the average error in the reported increases of production His conclusion is, *inter alia*, that the ascertained profit expressed as a percentage of the lowest of two harvests corresponds to the average percentage error of the products.

VAN BREMEN P. I. (Proefstation voor de Javasuikerindustrie). Samenvattende beverking van de resultaten der proefeldene bij de rietcultur op Java

Archif voor de suikerindustrie in Nederlandsch Indie, Year 1924, No. 15, pp. 465-475. Soerabaja, 1924.

58. **Peru : New Agricultural Experiment Station.** — A new station has been installed at Chuquibamba at the north of Juliaca and at a height of about 4000 metres above sea-level The Director is Colonel STORDY. About 18,000 acres of land are attached, with a total head of 15,000 cattle. (*Experiment Station Record*, Vol. 52, No 9. Washington, D. C, 1925)

59. **Russia : Volga Biological Station.** By arrangement of the Presidential Bureau of the Saratow Society of Naturalists this Station has just celebrated the 25th Anniversary (1900-1925) of its foundation The Station is under the direction of A L BEHNING

60 **San Salvador : Agricultural Experiment and Research in the Republic of San Salvador during 1924** - Official data are contained n the "Memoria" presented to the National Legislative Assembly of San Salvador by the Under-Secretary of State Ing Don MARCOS A LETONA on 126 February 1925 Good results have attended the working of the Experiment Stations "La Agronomía" and "Coiba" The first, situated at Izaloe, has sown cotton, maize and various sorts of vegetables, and in addition is used as a school (*Escuela Mayordomos*) Practical demonstrations are given there of progressive methods of cultivation the use of modern farm machines, selection of seeds, etc On "La Coiba" different types of coffee and cotton have been sown and experiments tried with the growing of a variety of plants, among them "Chalmoegra" plants imported from North America A third Experiment Station is also being organized, the "Zacatius" in the territory of Santa Ana.

The *Ministerio de Agricultura* has had published instructions relating to the sowing of cotton, a guide to the use of chemical fertilisers and has ordered the issue of four volumes of photographic illustrations of the principal plants of San Salvador, duly classified Studies of livestock diseases have been undertaken and an impetus given to pisciculture The Chemical Laboratory which is under the direction of Dr CARLOS BENSON has carried out a large number of analyses of agricultural products and of substances useful to agriculture as well as analyses relating to substances and products connected with other industries The Entomological Laboratory under the direction of Dr SALVATOR CALDERON is enlarged by the addition of a Botanical Section which is directly under the Department of Agriculture, and does admirable work in the field of phytopathology, by means of inspection and instruction on special points (Memoria de los actos del Poder Ejecutivo en los Ramos de Fomento y Agricultura, presentada ante la Honorable Asamblea Nacional Legislativa por el señor Subsecretario do Estado Ing don MARCOS A. LETONA ; el 26 de febrero de 1925. *Boletín de Fomento y Obras publicas*, Vol 11, No 10 and 11. San Salvador 1925).

Agricultural and Scientific Institutions and Associations.

61. **Germany: The Fortieth Anniversary of the German Agricultural Society.** – This occasion was celebrated during the autumn session of this Society (*Deutsche Landwirtschafts-Gesellschaft*) held from 21 to 26 September 1925).

62. **Spain: National Association of Spanish Olive-Growers.** — This Association (*Asociación nacional de Olivareros de España*) was formed on 30 June 1925. It is divided into two sections: olive-growing and olive oil manufacture. Its object is the study of questions of general and local interest relating alike to the cultivation of the olive and the processes of extraction of olive oil and the utilization of the residues of oil manufacture: the diffusion of instruction in the cultivation of olives and the production of oil. the encouragement of the production of olive oil, (shows, competitions, etc), co-operation (for the distribution of fertilisers, of selected slips, etc.; the institution of demonstration or experimental plantations, the compilation of statistics of olive cultivation or oil manufacture, adequate organization of production sale, export, etc.; submission to the Government of legislative and fiscal proposals in regard to problems of olive growing. research into and standardization of types of olive oil, information on foreign brands, commercial protection of producers, development of credit among members of the association despatch of missions and commercial agents, organization of warehouses and selling agencies purchase of trucks, tanks and other requirements for transport, etc. (From the *Estatutos de la Asociación Nacional de Olivareros de España*, Madrid, 1925).

63. **France, Brittany: The Société Scientifique de Bretagne.** — This Society has been formed with headquarters at Rennes, in connection with the Faculty of Science, with the object of forming links of study and research between all persons living in Brittany who are interested in the various sciences and their applications, encouraging their special work and facilitating the advance of scientific knowledge The members of the Society receive a Bulletin free consisting of four parts, one for each section of the Society, physical or mathematical sciences, chemical and pharmacological sciences, natural and agronomic sciences, biological and medical sciences (*Bulletin de la Société Scientifique de Bretagne*, Vol. I, part 1).

64. **Italy: General Inspectorate of Fisheries.** — An *Ispettorato generale per la Pesca* has been instituted by the Minister of National Economy and will deal with the technical and administrative questions relating to this branch of production Under this head will be included the following among others: stocking of public waters Examination of the terms of grants or leases of State waters Investigation of waters as regards breeding of fish or fishing. Technical supervision of the fish-breeding stations or hatching grounds Experimental fishing squads. Fishing cruises and seasons Decrees in regard to fishing with mechanical appliances. Inspection of markets Transport of fish. Statistical enquiries on the fishing industry. Subsidiary industries. Reports of the Committee of Marine Soundings (*Comitato Talassografico*) Vocational education of fishermen. (*Gazzetta Ufficiale*, 11 July 1925).

65. **Asia Minor: A Service for Selection of Plants and Seed Testing.** — The Government of the Turkish Republic is organizing in Asia Minor a service on these lines, and meanwhile a Swiss specialist, of the Federal Experiment Station at Lausanne is studying on the spot the means of securing as quickly as possible the improvement of the principal types of crops.

The headquarters of the service will probably be at Angora and Eski-Shehr, but in view of the great climatic diversity of the different regions of

Asia Minor, provision is being made for the formation of several sub-stations in certain localities During its first years attention will be given to investigation as to the improvement of cereal crops and if possible of tobacco.

The Turkish Government, which is trying in every way to encourage national agriculture and to increase the agricultural yield of Anatolia, has also called upon other specialists for assistance In this way there are already in existence a station of agricultural chemistry and a service for tropical crops

Congresses and Conferences.

66. **Belgium: Meeting of the International Committee on Household Management Instruction, Brussells, 16 July 1925.** — This was held on the occasion of the International Exhibition at Laeken The agenda included. 1 Efficiency methods in town and rural household management, 2 Application of electricity of machinery and other processes for facilitating domestic labour in towns and country districts

67. **Belgium: International Committee on Home Training, Brussells, 17 July 1925.** — Agenda: 1. Extension of the instruction in the elements of Home Training to all classes of society in the different countries, 2 The steps taken and the results obtained for building up the funds required for the development of the International Institute of Home Training

68 **Belgium: International Committee of Farm Womens' Clubs, Brussells, 18 July 1925.** — Agenda, I Progress of Farm Women's Clubs in the different countries and suitable methods of encouragement, 2 Proposals for the organisation of an International Congress of Farm womens' Clubs

69 **France: International Dairying Week at Lyons, 5-12 September 1925.**

70 **Scotland: First Conference of the World Federation of Education Associations, Edinburgh, 20-27 July 1925.** — This Federation was founded in July 1923 at San Francisco (U S A.). The subjects discussed at the Conference were I The under school age period and kindergartens, 2 Elementary schools, 3 Secondary schools, 4 Character training, 5 Illiterates; 6. The teaching of adults, 7 Training of teachers; 8. Problems of hygiene, 9 The World University, 10. The teaching of history from the international point of view.

71. **Italy: First International Malaria Conference, Rome, 4-6 October 1925.** Five sections: 1. Anopheles and malaria; 2 Biology of the parasites, single and multiple parasites, 3. Alkaloids and quinine and the therapeutic treatment of malaria, 4. Epidemiological factors and therapeutic treatment of malaria, 5 Propaganda and statistics The foundation in Italy of an International Institute of malarial studies was discussed and approved

72. **Rumania: Sixth International Chemistry Congress, Bucarest 22-25 June 1925.** — This was held under the Chairmanship of Sir WILLIAM POPE, F R S, Professor of Cambridge University and President of the International Union of Pure and Applied Chemistry. Eighteen nations took part in the Conference: an important resolution was passed in reference to the

International Research Council (*Conseil International de Recherches*). Unanimous approval was given to the resolution inserted, by request of the Copenhagen Conference, in the agenda of the Bucarest meeting. This resolution recognises that it would be advantageous for the International Research Council so to amend its rules that any country on becoming a member of the League of Nations should be admitted to membership of Unions affiliated to the International Council. Amongst various technical questions discussed, Professor F. GIORDANI of the Naples Polytechnic dealt with the problem of nitrogen. A desire was expressed on behalf of the Belgian delegates that the Union would study improved methods of preservation of paper and ink and Rumania expressed the wish that the Union would take up the question of agricultural chemistry. It was decided that these two last questions should be considered by the sections concerned of the Consultative Committee of the Union on which a certain number of nations are already represented. Professor E. FOURNEAU (France) member of the *Academie de Médecine* and Director of the Pasteur Institute dealt with the relations between the chemical composition of bodies and their physiological properties.

In regard to the headquartes of the next Conference the invitation of the American Delegate was accepted to hold the Conference at Washington in September 1926. This is the more appropriate as the United States are then to commemorate the 150th anniversary of their Independence and the American Chemical Society the 50th anniversary of its foundation.

73. **Poland : XII International Congress of Agriculture, Warsaw, 21-24 June 1925.** As a continuation of the notice of this Congress appearing in an earlier number (Vol. III, 3) some account may be given of the resolutions adopted by those Sections which discussed subjects of more general importance, and more closely connected with the scope of this Review, viz. the problems of the rural industries and of agricultural instruction. In the next number, some detail will be inserted as to the subjects of technical importance handled by the Congress.

Section IV. *Agricultural Industries.* 1. The Congress recognises that the guiding policy should be that of inducing agriculturists, small and large, to prepare their own products, and to secure the sale, and that it is therefore necessary to consider : (*a*) the formation of producers' unions and the due establishment by these unions of the funds required for the transformation of the existing organisations into co-operative societies or profit-sharing associations ; (*b*) the training of the experts who are required to manage these societies and to ensure their progress. In the meantime while waiting for the complete realisation of this scheme, an undertaking should be obtained from the manufacturers who transform agricultural products that once the cost price, either of the raw material, or of the process, is covered, the profits or losses shall be charged proportionately to the capital invested in the production or transformation of a single unit of produce.

2. In view of the importance of the industrialisation of agriculture and especially of industrialisation based on co-operation, it is recommended that information relating to the type of management, the form of organization and the financial results obtained in co-operative societies of the purely industrial type as well as in co-operative agricultural societies for purchase and

sale, should be collected throughout the world and published under the form of a special report by the International Institute of Agriculture.

3. With the object of developing agricultural production, the industrial use of alcohol should be intensified in every possible way.

In addition Section IV approved the following conclusions with reference to the cultivation of beet root sugar.

A Permanent Office of Sugar-beet Growers should be set up at the International Institute of Agriculture; competitions should be arranged in regard to the implements required for the mechanical labour used in the cultivation of sugar-beet: an International Commission of Sugar-beet Growers should be formed for the study of methods of organisation of work and for propaganda in favour of the consumption of beet sugar; the tendency to apply agricultural principles to the sugar industry should be strengthened, the application varying in each country in respect of form; steps should be taken in the different countries to safeguard beet cultivation and the beet sugar industry.

Section V *Agricultural Instruction* As regards the diffusion of agricultural knowledge among the mass of the rural population, a resolution was passed for the collaboration, both in respect of organization and finance, of the Governments, the Chambers of Agriculture, the agricultural associations, etc The practical work in connection with this will devolve upon the associations with rural bias, e. g farmers' clubs, farmwomens clubs, etc, these latter to be formed wherever required The instruction should be supplemented by lectures suited to the different localities, by visits to experiment stations, farms, etc, excursions and practical demonstrations, the organization of farm apprenticeships, suitable literature libraries, etc The propaganda for agricultural education must without exception be conducted on lines parallel to the organisation and advance of agriculture, further, in view of the importance of womens' work in the country, a special section should be instituted at all future congresses for the study of problems relating to rural housewifery

The problem of agricultural instruction among the masses was then considered from the point of view of general education given with a rural bias and so arranged as to exercise a valuable influence on the development and improvement of the general conditions of rural life Primary education should be so designed as to encourage a strong feeling for the country side, and with a view to making the school work more instructive and recreative, practical work and excursions should be multiplied, while every rural primary school should have its demonstration garden and its natural history collections The training college courses must in their turn be adapted to form the character of the teacher to impart a love of the country, the development of resource fulness in adapting instruction to local needs, and an interest in taking a share in the improvement of the agricultural and social conditions of the district.

As regards the organisation of farm apprenticeship, the Congress has finally resolved that the managing heads of the lower and middle agricultural schools should themselves direct the apprenticeship courses of their pupils, and the lecturer in the higher schools should assist in the drawing up of the scheme of apprenticeship.

The apprenticeships, should cover at least the periods of the more im-

portant field work and for that purpose full advantage should be taken of the winter, spring and autumn vacations Those who do not intend to specialise should complete their practice on farms which are well managed and of high yield The object of apprenticeship which is coincident with a course of study is to initiate the apprentices into manual work, agricultural work in general and organisation of work In this way the knowledge acquired in theory is deepened and skill in management of the farm is attained

An international exchange of apprentices with visits to wellknown farm undertakings and establishments for special forms of production might be organised on a large scale (Received by the Institute from the Secretariat of the Organising Committee of the Congress)

74 **Switzerland : International Congress on Agriculture. Davos August 1925.**

75 **Germany : Fourth General Meeting of the Colloid Associations (Kolloid-Gesellschaft). Nuremberg, 5-7 September 1925.** – This meeting was held immediately after the fourth general meeting of the Society of German Chemists, (*Verein Deutscher Chemiker*) The principal subject of discussion was experimental methods of Colloid Chemistry

76 **France : Congress of the Scientific Societies of Burgundy, Auxerre, 5-7 June 1925.** The agenda included in the scientific section agricultural and botanical maping

77 **Flanders Hop Week. Hazelbrouck, 4-12 October 1925.** — This was held on the occasion of the Flanders Hop Competition organised by the Hop Cultivators? Union

78 **Italy : Second Conference of South Italian Agriculturalists, Rome, 29-30 June 1925.** This Conference was summoned by the Organising Committee of the Consortia of land improvement for Southern Italy and the Islands Subjects discussed Avv A MARTINI Land improvements of Calabria Avv D S CECI The Improvement of the Tableland of Apulia in certain technical and legislative respects Prof E CONGEDO The work of the Co-operative Societies in connection with the carrying out of improvement schemes, Cav D LACAVA The work of the Committee Legislation for control of Malaria, Ing R CURATO Irrigation in the South of Italy from the technical and economic point of view Prof C CIMINO Defects and omissions in the land improvement and agricultural credit legislation with referencedo Southern Italy Prof G SCALISI Needs of Southern Italy and their financies, Dr L FANO Land improvement legislation and the work of the Consortia, A MAZZOTTO The Improvement of agricultural land, Dr A RIZZO The improvements in the provinces

79 **Italy : Conference of the Lombard Silk Worm Breeding Agricultural Institutions. Milan, 11 July 1925.**

80, **Italy : First National Congress of Importers and Exporters, Milan, 5-6 December 1925.**

Exhibitions, Fairs and Competitions.

81. **Austria : International Agricultural Exhibition. Vienna, 6-13 September 1925.**

82 **Great Britain : 7th International Tobacco Exhibition, London, 9-16 May 1925.** — Organized by the London Tabacco Associations Eight nations represented Czeco-Slovakia Cuba, Egypt, Greece, Italy, Holland, United States, Turkey

83 **Switzerland : International Exhibition of Inland Navigation and of the Exploitation of Hydraulic Power, Basel, 1 July-15 September 1926.** — The exhibition will be held on the occasion of the inauguration of the new Rhine Port installations, as initiated by the city of Basel

84 **The 32nd Travelling Exibition of the German Agricultural Society (D. L. G.)** — This exhibition will be held in Breslau (Silesia) from 31 May to 6 June 1926 Special trains at reduced fares will be run in connection with the Breslau Travelling Exhibition from 31 May to 6 June for societies and members of agricultural authorities A reduction of 35 per cent will be made on the ordinary fares Tickets for the special trains for the members of agriculturel authorities will be sold by the State Railway Company up to two days before the dates on which the trains are advertised to run In the case of the sale of an insufficient number of tickets only the train will be cancelled Passengers will probably be able to return from Breslau by any of the ordinary trains Requests for special trains should be addressed without delay by agricultural authorities to the offices of the Society Berlin S W 11 Dessauerstrasse 14

The reduction for societies when the party consists of less than 30 members, is 25 % for second third and fourth class tickets Schools of Agriculture, High schools etc, may obtain a 50 % reduction for a party of at least ten persons

85 **Germany : National Exhibition of " German wine " (" Deutscher Wein "), Coblenz, 8 August-13 September 1925.**

86 **Germany : Twentieth Brewery Exhibition, Berlin, 5-13 October 1925.** — This was held on the occasion of the Autumn meeting of the Experimental Brewing Institute at Berlin (*Versuchs-und Lehranstalt fur Brauerei*) and it coincided in time with the XXII Exhibition of Barleys and Hops Particulars may be had from *Institute fur Garungsgewerbe*, Seestr, 12-15 Berlin *n*° 65

87. **Austria : Sample Fair, Innsbruck, 4-11 October 1925.**

88 **Austria : Second Brown Swiss Breed Bulls Fair, S. Michele near Leoben, Styria, 20 September 1925.**

89 **Egypt : Agricultural and Industrial Exhibition, Cairo, 20 February-6 March 1926.** — *Agricultural Section* 1 Agricultural products, 2 Agricultural industries 3 Live stock 4 Poultry, 5 Stock Hygiene, 6 Agriculture, 7 Fruit, 8 Sericulture *Industrial Section* 1 Motor machinery, 2 Farm implements etc, 3 Transport equipment, 4 Textile products, 5 Furniture, 6 Rural buildings

90 **United States : Cattle Show, Portland, 31 October-5 November 1925.**

91 **United States : Petroleum Exhibition, Tulsa, 1-10 October 1925.**

92 **France : Olive Oil Exhibition, Lyons, 5-12 November 1925.** — Five sections Olive oil, Preserved olives, By-products, Packing materials, Machinery

93. **Italy : Electro-cultivation Exhibition, Milan, 12-27 April 1926.** — The exhibition will include . 1) a section for special electric machinery movable transforming huts, transportable motors, etc) , 2) a section for farm machines of various kinds driven by electric power , 3) a ploughing demonstration ; 4) an exhibition of miniature models, of drawings and photographs of reclamation works, irrigation, etc , carried out by electrical methods ; 5 cinema films showing machinery which is too heavy to be transported to the exhibition

94. **Italy: Grain and Peach Show, Verona. 9-12 August 1925.**

95 **Italy: Stock Show, Como, 1-2 September 1925.**

96 **Rumania : Sample Fair, Chisinau, 15-30 September 1925.**

97. **Switzerland : Brown Swiss Breed Bull Fair, Zug, 2-4 September 1925.** — Organised by the Swiss Federation of the Consortia for Brown Swiss Breed

Development of Agriculture in Various Countries.

98. **Austria: Agrarian Reform.** - Under this title (*Die Agrarreform Oesterreichs*) Dr HERMANN KALLBRUNNER of Vienna has published an exhaustive critical article, dealing with the subject especially from the legislative point of view (*Berichte über Landwirtschaft*, published by the German *Reichsministerium für Ernährung und Landwirtschaft*, New Series, Vol III, Part I, pp 124-136 Berlin, 1925)

99. **Florida and Rubber Production.** — — At the present time the United States utilise 75 % of the world's total production of rubber, but produce only 2 % and the United States rubber interests have studied Florida as a rubber producing State The average yield of plantations in the East is about 300 lb per acre, at which rate 2,725,300 acres would be needed to supply the United States' requirements The climate is satisfactory and an area of over 5,000,000 acres has been found which is considered to be suitable when drained. The cost of labour in Florida would prevent profitable cultivation of Hevea unless other methods of latex extraction can be discovered, but this drawback may not apply to other types of rubber plants, from which the latex may be extracted by mechanical methods Extensive experiments are being carried out. (*India Rubber World*, Vol LXXII, No 3, 1925)

100. **United States to grow Rubber in Liberia.** — American rubber interests have negotiated for an extensive tract of land (about 1,000,000 acres) in Liberia for growing plantation rubber on a large scale It is expected that yields of crude rubber will be available in five years (*The India Rubber World*, Vol. LXXII, No 5, New York, 1925)

101. **Crop Production in India:** A critical survey of its problems, by A. HOWARD, C I. E., Director of the Agricultural Experiment Institute, Indore Central India (pp 200, 10*s*. 6*d*, Oxford University Press, London) (« *Nature* », July 4, 1925)

102. **Rumania : State Co-operation in the Improvement of the Cultivation of the Expropriated Lands.** — An article appears on this subject in the *Buletinul Agriculturei*. The author first expresses some general views on the agrarian reform in Rumania, giving statistics of the appropriation and

division of the land He then reviews the measures taken by the Rumanian Government for a rapid improvement of agricultural production On the completion of the agrarian reform, the confusion introduced into the cropping of the following year was such as to reduce considerably both the cultivated area and the quality of the products, thus showing that the peasant cultivation did not fully meet the requirements of the time and of the country The State immediately introduced measures calculated to systematize and improve production while at the same time exerting a direct influence on peasant cultivation Factories were put up, nurseries made and centres of scientific agriculture were established according to modern principles At the same time the *Casa Centrale a Improprietarirsi* (Central Bank of Landowners) by means of the *Centrala Obstiilor Satesti* undertook extensive propaganda work with a view to grouping the peasants in agricultural co-operative societies through which farmers are to be supplied with agricultural machinery, utensils, etc., and which at the same time secure the sale of the produce of members Hence in the former kingdom there came into existence 315 agricultural co-operative societies with 19,270,586 lei of subscribed capital, and 16,835 members and a paid up capital of 3,917,613 In Bessarabia 476 agricultural co-operative societies were constituted with 27,156 members and 7,736,786 lei of subscribed and 1,064,355 paid up capital In Bessarabia, following on the winding up of the "*Casa Noastra*" another 20 agricultural co-operative societies were instituted with 1748 members, subscribed capital of 750,570, and paid up capital of 141,896 lei In Ardeal the old type of co-operative societies were by degrees transformed into co-operative societies of the type existing in the former Kingdom, the whole agricultural co-operative movement thus becoming homogenous In Bukovina co-operation is still in early stages In addition to these measures and the grant of one million lei for addition to the livestock, the State has organized district exhibitions as a means of supervising and stimulating agricultural producers In February 1924 the Congress of the Societies of Agricultural Experts drew up a complete programme of new practical measures based strongly on government support, which are being carried into effect at the present time (*Chitoiu D C* Agrarian Reform in Rumania, *Buletinul Agriculturei*, Vol IV, 1924, October-December, No 10-12. Bucarest)

103. **Rumania: Settlements in Transylvania.** — The policy adopted by the Rumanian Government of transferring part of the population of the mountain districts to the extensive, thinly populated areas of Western Transylvania, is being carried out in accordance with economic principles, the settlers being accomodated in new villages

The success of these settlements largely depends on the extent to which the State is prepared to assist the settlers (CIOMAC L I. "Colonizarile din Transilvania" *Viata Agricola,* Year XVI, No. 5, pag. 141-143 Bucarest 1 March 1925)

104 **Rumania : Assistance to Agriculture in Bessarabia.** — VERSCOGLI, writing in *Viata Agricola,* a Rumanian periodical, gives a vivid description of the deplorable state of the orchards, which are ravaged by parasites, of fields overrun with weeds, and of the utter ignorance of the peasants as regards rotation of crops and modern methods of cultivation. The writer

suggests, as likely to benefit cultivation in Bessarabia, organization on the following lines:

1. Model gardens and experimental fields,

2. Depots for the distribution of seeds, insecticides and agricultural machines to the population, at cost price,

3. Plots for the production of selected seeds, utilising for this purpose the allotments so assigned under the agrarian reform;

4. Seed-testing stations and selection farms,

5. Inspection of plant nurseries,

6. Higher schools of agriculture, the issue of leaflets on farming subjects intended for the agricultural classes, courses on all the various branches of agriculture.

Miscellaneous.

105. **Brazil: Rural Welfare Work.** – The following information of the health measures undertaken in the rural districts is taken from an article by Dr R. D'ALMEIDA MAGALHAES, General Secretary of the National Department of Public Health in Brazil. This form of welfare work was begun in 1917, when prophylaxis was first introduced. With the formation of the Department, sanitary organisation on definite lines was undertaken. In 7 States, this work is in the hands of expert officers of the Federal Government who collaborate with the authorities in each State, expenses being shared by the Central Government and the government of each State. The offices of the service are situated in the various State capitals, and from these centres superintendence is effected of the country town dispensaries, many of which further by all means in their power the increased use of prophylactic measures. With this co-operation on the part of the country towns, an efficient health organisation is being gradually formed which has already done good work in combatting the two serious endemic diseases of the Brazilian rural districts, anchylostomiasis and malaria, the methods followed being actual medical treatment of the sufferers and the installation of drainage works on a small scale.

District hospitals have been established in some States. (Dr R. D'ALMEIDA MAGALHAES Progreso Sanitario do Brasil. *Boletin Commercial do Brasil* year IV, No 25. Rio de Janeiro, 1925).

106. **Brazil Forest Reserves.** – J. REZENDE SILVA in the *Boletin do Ministerio da Agricultura, Industria e Commercio* (Year XIV, No 6, Rio de Janeiro, 1925) discusses the organisation of the forest service of the Republic in reference to the Decree of 28 December 1921 by which the Service was instituted. The writer enumerates the various types of lands which could be utilised by the Federal Government for purposes of re-afforestation, and expresses the opinion that the Ministry of Agriculture, Industry and Commerce should direct that a detailed report should be prepared, giving full particulars relating to area, location, nature, etc., of all the Federal lands. On the basis of this report for which the assistance of the various departments and officials would be required throughout the Republic, it would be possible to prepare a map of these areas.

107. **Denmark: Fruit Storage Experiments.** — Experiments in the storage of apples and pears were begun in 1918 at Blangsted (Denmark) in a building erected in 1917 and consisting of an ordinary cellar and a cold storage plant of fruit Comparisons were made between storage of apples and pears in cellars and in cold storage rooms at temperatures of 4.5, 3 5, 2.5, 1 5, 0 5° C Other experiments were carried out in cellars and cold storage rooms which were (*a*) unventilated, (*b*) ventilated, (*c*) with the addition of ozone

The main results were as follows:

The keeping power of fruit varies greatly from year to year All varieties of apples and pears kept much longer in a cold storage room than in a cellar During the winter months, after removal from cold storage, fruit kept fresh for at least two weeks, with the exception of the variety Nouveau Poiteau, in which core rot was found The flavour of apples does not seem to be affected by the temperatures or duration of storage Pears picked before they are ripe do not obtain a good flavour when ripened at a low temperature Some varieties lose flavour under protracted storage Ventilation with outer air or the generation of ozone, does not seem to increase the keeping power of fruit Scabby fruit does not keep as well as sound fruit Wrapping the fruit in tissue paper seems to have no preservative effect, but generally enhances its beauty Fine, dry, powdered peat as a packing material increases the keeping power of fruit by one month or more Large fruits do not keep as well as smaller ones from the same tree (*Ice and Cold Storage*, Vol. XXVII, No 317, London 1924)

108 **Egypt. Agricultural Films** — In an article in the *Bulletin de l'Union des Agriculteurs d'Égypte*, PIERRE ICHAC, Ing Agr draws attention to the advantage which Egyptian agriculture would derive from a use of the cinema, on lines similar to those followed with successful results in many European and American countries The writer points out that throughout the valley of the Nile lectures could be given accompanied with films, the necessary apparatus being transported on lorries These lectures would deal with purely agricultural matters and with such rudimentary principles of hygiene and local prophylaxis as may be of practical use to the fellah (P. ICHAC Le Cinéma au service de l'agriculture (*Bull Un Agr d'Égypte*, Year 35, No 162, Cairo, 1925)

109 **United States: Agricultural Films** — The Department of Agriculture of the United States has published an interesting circular in the form of a leaflet from which may be gathered abundant data on the agricultural propaganda in these States carried on by means of films An explanation is given of the methods of distribution of the films and of the way to apply for their loan. The individual or organization asking for them is expected to pay only the postage or transport expenses both ways The application must be addressed to the *Office of Motion Pictures, Extension Service, United States Department of Agriculture, Washington D C.*, Copies of the films may also be bought at prices already fixed, and the conditions governing such purchases are that no changes are to be made in the subject matter of the films without approval from the department and that no commercial or advertising matter be added to or inserted in the film Titles in foreign languages, if desired, may be obtained at additional cost.

A catalogue of the films of the Department is added. The titles are arranged by subjects and reference is made in each case to the special Department (Bureau of Animal Industry, Bureau of Dairying, Bureau of Entomology, Bureau of Plant Industry, etc.) The films thus treat of farm animals, (cattle, horses, sheep, swine, fowls) wild animals, crops, rural engineering, forestry, entomology, trade in agricultural products, rural organization (Motion Pictures, of the United States Department of Agriculture, *Miscellaneous Circular* No. 27. Washington, 1924)

110. **Fisheries in the Antilles.** — A number of American scientific Institutes have decided to contribute 100,000 dollars for the organization of a mission which is to make deep sea soundings and to examine the possibilities of fisheries in the waters of the Antilles. (*Revue générale du Froid et des industries frigorifiques*, Year 6, No. 8. Paris, 1925)

111. **United States: Discovery of Potash Deposits in Texas.** — The Geological Survey of the United States has recently discovered extensive potash beds in Texas. The mineral is in the form of polyhalite, analyses from borings giving from 4 to 11.21 % K_2O.

The tract of country in which potash has been found is about 275 miles by 125 miles, but data are not yet sufficient on which to base accurate estimations as to area or value; geologists are of the opinion, however, that the beds will be found to be of large extent. (*American Forests*, Vol. 31, No. 375, Washington, D. C., 1925)

112. **Forest Fires.** — Ing. F. MICHETTE, president of the *Institut de la Science du Feu* has recently published a critical study on the subject of forest fires. The writer discusses the theories held as to the outbreaks of fire among growing trees or plants and the methods adopted for extinguishing such fires. After a clear exposition of the various conflicting views, he rejects the majority and comes to the conclusion that forest fires are caused solely by spontaneous combustion. This being the case, the only effective means of checking the fire, once it has broken out, would be the removal of the forest litter. The writer deals exhaustively with the practical and theoretical aspects of the problem and the methods adopted to prevent and check these conflagrations. (FELICIEN MENOTTE, Étude sur les incendies de forêts. *Institut de la Science du Feu*, pp. 64, 8vo. Paris, 1925)

113. **Report of British Cotton Growing Association**, presented at Manchester, June 12, 1925. The following information is contained in the Report: In India, sufficient seed of American types of cotton was distributed in the Punjab last season to plant 100,000 acres. The output of Uganda amounted to 126,600 bales, valued at L.3,500,000. Tanganyika exported 17,500 bales. The Soudan produced 46,000 bales and the land is ready for planting 100,000 acres in the Makwar Dam area. The output of Iraq was 2,500 bales, a considerable increase, but production is limited by lack of irrigation and salinity of the soil due to absence of drainage. The estimate for Queensland for the present year is 17,000 bales. Excluding India, the total output for the British Empire for 1924 is 261,900 bales, as compared with 179,500 bales in 1923. By December 1926 it is estimated that the total will reach 500,000 bales.

114 **Africa : Reclamation Schemes in the Sahara.** — The French Academy of Colonial Sciences (*Académie des Sciences Coloniales*) has opened a competition for 1925-26 on the subject of the Sahara Competitors are required to discuss the following particulars 1 Scientific data, 2 Technical procedure, 3 Stages of the work, 4 Financial measures, 5 Future prospects The competition closes on 1 October 1926 The winner will be awarded a prize of 12 000 francs Two or more writers can be allowed to collaborate Enquiries *Académie des Sciences Coloniales*, rue Mayet 16-bis, Paris (VI[e]

115 **Shirley Institute Memoirs,** Vol 3, 1924, pp 362 (British Cotton Industry Research Association, Manchester). The volume includes twenty-seven original papers in cotton research and contains an excellent summary of the literature on the action of light on dyes applied to cotton fabrics. ("*Nature*" August, 1, 1925).

116 **Scotland : Experimental Sugar Beet Cultivation.** — According to the report of the Commission appointed by the Scottish Board of Agriculture to ascertain whether the beet sugar industry could be successfully introduced into Scotland, experiments carried out in beet cultivation in various parts of Scotland, including the northern counties of Aberdeen, Moray Nairn and Banff have given satisfactory results The Commission is of opinion however that further investigation is necessary, while farmers should be properly acquainted with the methods of cultivation required before the scheme can be entertained as a profitable commercial proposition Experiments must also be made to ascertain the most suitable time for sowing. *Circulaire hebdomadaire du Comité Central des fabricants de Sucre de France*. Year 37, No 1893. Paris 1925)

117 **Australia : Refrigerated Fruit Transport.** — At a recent meeting of the Australian Fruit Council a committee was appointed to draw up a report dealing with scientific research on the transport of fresh fruit It was proposed that the separate sections of technical research undertaken in the various States should be co ordinated, preferably in co-operation with the University of Cambridge It was suggested that the subject of fruit transport be divided into three main sections (*a*) the fruit (*b*) the ships' hold, (*c*) co-operation between producer and ship s engineer The cost of the work to be shared proportionally by the Governments concerned It is anticipated that the work could be carried out in about three years (*The Fruit World of Australasia*, Vol XXVI, No 6 Melbourne, 1925)

118 **South Africa A Successful Co-operative Cotton Ginnery.** — The author gives a brief account of the history of cotton ginning, and the advantages to be derived from co-operation in this industry, especially as regards standardisation of the product The Barberton Cotton Co-operative Company, formed in 1923, and its work is then described, and a summary of the regulations is given, which should be of interest to growers farming similar societies

The following advice is given to growers It is cheaper and more satisfactory to gin cotton which has been pooled according to grade, type and staple, as the gins can then make long runs on one grade If a grower sends four grades for separate ginning, the gin will have to start four times, for short runs This means extra supervision, and the advantages of a large, modern

equipment are entirely lost Growers are advised to pool their cotton, and to state merely whether their cotton is to be sold in South Africa or on the European markets (*Journal of the Department of Agriculture, Union of South Africa*, Vol IX, No 5, 1924)

119 **Sugar in Kenya.** — British East Africa — now Kenya Colony and Protectorate — was until 1920 virgin soil from the point of view of the sugar industry For many years cane had been grown by both natives and Indians for their own consumption and the manufacture of a crude molasses sugar known as "jaggery" As with all sugar territories, molasses sugar has paved the way for its successor, the centrifugal product

In 1920 a valuable tract of 10,000 acres was secured by a commercial company, in the famous Kavirondo Valley, bordering on the native reserve and situated 570 miles from the Coast, while 18 miles further inland is Kisumu, Kenya's present terminus of the Uganda Railway on the shores of Victoria Nyanza The altitude of the estate is approximately 4000 feet above sea level and it is about 4 miles south of the equator

The Kavirondo Valley is really a speck in the Great Rift Valley which cuts Africa in half longitudinally Its dimensions are approximately 60 miles by 35, a good deal larger than the island of Mauritius, where 250,000 tons of sugar are produced per annum. This valley is an exceedingly fertile area inhabited by and reserved for the Kavirondo tribe, who number about 1,000,000 The soil, an accumulation of centuries of silt washings from the surrounding ranges, varies from a red decomposed granite on the slopes to a rich, loose, black cotton loam on the plains Practically the whole area is well watered by countless small streams from the enclosing mountains There are also possibilities of irrigation from Victoria Nyanza and the day no doubt will come when the waters of the world's largest fresh water lake will be harnessed for power and agriculture throughout the valley A dry climate, with an average yearly rainfall of 45 inches, will make white settlement a lucrative agricultural proposition

The labour question to-day is probably without parallel in any part of the world The Kavirondo is docile and tractable and his shortcomings in energy are balanced by his low wage of ten shillings per month, with a food ration of maize meal

The Victoria Nyanza Sugar Company actually commenced operations in 1921, and planted a drought-resisting cane known as "Uba", probably of East Indian origin Subsequent propagation of various canes from Australia and Java, together with the Central African native cane "Kampala", is proving successful, though, as yet, Uba is responsible for 90 % of the crop

Maturity is reached after 20 months and a short experience of plant and ratoon crops indicates that a 20 ton crop per acre, averaging over the 2nd ratoon, may reasonably be anticipated Uba is a hardy cane of 15 % fibre and approximately 13 7 % sucrose, and contains an excess of gums and reducing sugars which make its milling and white sugar extraction a matter of greater difficulty than is the case with the softer canes of other countries

The Company possesses (1924) a modern 14 roller mill and with an output of 25 tons per hour A good class of plantation white sugar is being turned out for local consumption and East African export

New ground has been broken and further developments are in prospect as there is little doubt that Kenya offers excellent prospects as a sugar producing country (Comunicated by Mr. G. R. MAYERS *Managing Director, Victoria Nyanza Sugar Company*).

Since receipt of the above, the 1924-25 *Report* of the Company has appeared and shows that, during that period 20 073 tons of cane where treated and 1385 tons of sugar manufactured. The total area planted is 3870 acres. (*Ed*)

120 **History of Literature on Cheese-making.** — According to a carefully written article by Prof. COSTANTINO GORINI, with an ample list of references, the first reliable writings dealing with cheese-making appeared in 1834, in the form of essays sent to the International Competition held by the Royal Institute of Science, Literature and Art (*I R Istituto di Scienze, Lettere ed Arti*) of the Lombard-Venetian kingdom in 1834 The competitors were required to send a paper on "subjects closely connected with the improment of cheese, with a view to establishing certain definite methods of improving the quality of cheese and increasing the quantity produced", an exacting task, as GORINI remarks As a result of this competition, in which seven competitors took part, two studies were published. one by L PELLEGRINI, doctor of medicine and professor of physics chemistry and botany in the University of Pavia, and the other by RIBONI of the Botanical Gardens of Pavia

GORINI briefly reviews these two studies (the first of their kind) and gives an account of similar competitions subsequently held by the Society for the Encouragement of Arts and Crafts of Milan (Società di incoraggiamento d'Arte e Mestieri), and the Royal Lombard Institute of Science and Literature He also mentions other writings dealing with the subject, by PIETRO ALBERTI (1846), CARLO ANTONIO LANDRIANI (1847), GIOVANNI FRANCESCO SELMI, professor of physics, chemistry and mechanics applied to arts, of the *Collegio Nazionale di Torino*, and DAVIDE NAVA, teacher of chemistry in the Milanese Society mentioned above These writers were followed in more recent times by MUSSO, MENOZZI, PIROTTA, RIBONI, GAETANO CANTONI, SORMANI and GIGLI It was only in 1878-9, however, that the bacteriology of milk was first dealt with in Italy, the subject being mentioned in four letters written by PIROTTA and RIBONI In the last twenty years GORINI has himself published books on microbiology in connection with cheese, and Milan has thus kept up a tradition which led to the study of cheese-making from the biochemical standpoint, an example which is now being followed on other countries (Prof COSTANTINO GORINI "L'Istituto Lombardo, culla di studi caseari". Rendiconto del R. Istituto Lombardo di Scienze e Lettere, series II, Vol LVIII, No 1-7 Milan, 1925)

121 **Ths Study of Flora in the Dutch Indies.** — The Bulletin of the Botanical Garden of Buitenzorg, published at Batavia and edited by Drs. W M VAN LEEUWEN, F. VON FABER, I. G. B BEUMEE (of whom the last named suceeded Dr J. J SMITH in the directorship of the Herbarium) contains a scholary study on the Sapotaceae, Sarcospermaceae, and Boerlagellaceae of the Dutch Indies, Malay peninsula and Philippine islands, penned by Dr. H. J. LAM. The writer has availed himself of the large collection possessed by the Herbarium of Buitenzorg, and the two Herbariums of Manila and Sin-

gapore. The subject is handled in an accurate and original manner, its interest being enhanced by many excellent illustrations ("*Slands Plantentuin*", *Jardin Botanique de Buitenzorg, Bulletin*, Series III, Vol VII, Nos 1-2, 289 pp. in-8°, 65 ill Batavia, 1925)

122 **Rumania : Cotton Growing.** — Following on careful study and practical testing of the best known varieties of Egyptian and Macedonian cotton, and other varieties, the Rumanian Ministry of Agriculture has had the following varieties of cotton seed imported into the country and placed at the disposal of cotton planters : "Sakellaridis", a late maturing variety, suitable for irrigated plantations, it is most in demand on the market, and has the longest, softest, and strongest staple, "Pelion", medium growth suitable for plantations situated in the Danube lowlands, "Ashmuni", a quickly maturing variety, suitable for Oltena and the Banat, and "Balcanica" for Southern Dobrudja and Quadrilaterre. ("*Viata Agricola*", Year XVI, No 6, p 90 Bucarest, March 15th 1925)

123 **Rumania : Introduction of Medicinal Herb cultivation.** — In view of the fact that the climate of Rumania is particularly suitable for the cultivation of most medicinal plants, which already form a considerable portion of the Flora of Rumania, the Department of Agricultural Instruction in the Ministry of Agriculture decided, at the beginning of 1925, that these plants should be introduced into all the Schools of Agriculture It is intended subsequently to extend the cultivation of these plants with a view to producing a sufficient supply for Rumania's requirements, and in course of time, adding materially to the country's revenue by exporting them ("*Viata Agricola*", Year XVI, No 6 Bucarest, March 15th 1925)

124 **The Works of** Celso Ulpiani. — The complete works of this Italian biologist, which possess so high a value for agriculture, are being collected by Prof. De Dominicis into one volume of about 1500 pages in 16.mo For copies apply to the widow of the late scientist, Signora Emma Ulpiani, San Benedetto del Tronto, Ascoli Piceno, Italia.

Journals and Reviews.

125. The 156th volume (nos 1-4) of the *Biochemische Zeitschrift* takes the form of a jubilee number to celebrate the 60th birthday of Max Cremer, professor of physiology in the Veterinary Institute in Berlin The volume contains about 400 pages, with illustrations, and articles written by eminent German and foreign biologists Among those who have collaborated are Abderhalden, Rosenfeld, Magnus-Levy, Pringsheim and others.

126. "**Boletin Arrocero**". is the title of the official organ of the Union of Rice Planters, Chamber of Sueca, Valencia, Spain (*Unión Agricultores Arroceros y de la Cámara Arrocera de Sueca*). The first number of this bulletin, which is edited by D R. Font De Mora, appeared in April 1925 ; and the value of the periodical both from the practical and scientific standpoint, is apparent from the numbers that have so far appeared Rice problems affecting Spain and other rice-growing countries are discussed in the periodical. — Editor and Publisher : Calle del Maz, 29, pral. (Valencia).

127. " **Wheat Studies** " is the title under which the Food Research Institute of the Standford University, California, is publishing a series of essays dealing with wheat problems throughout the world The numbers forming the first volume appeared monthly from December 1924 to April 1925 Each article is illustrated by numerous diagrams

128 The **Revue Agricole de l'Afrique du Nord** has devoted a special number to Co-operative Cereal Stores in Burdeau, Algeria This co-operative elevator started work on July 21st 1925, and handles grain produced in the Serson region, which is particularly suitable for cereals The warehouse which is very extensive, is provided with mechanical appliances and may be compared to the American " Elevators " and German " Kornhauser " There are two other co-operative elevators in Algeria, one at Brazza (department of Algiers) and one at Maalifs (department of Orano) Both of these are smaller and are not provided with machinery (BOYER-BANSE and FURGIER Le dock coopératif à céréales de Burdeau *Revue Agricole de l'Afrique du Nord*, Year 23, No 301. Algiers 1925)

129 **France: A new Bulletin for Togo and Cameroon.** In accordance with instructions given by the two French Commissioners in Togo and Cameroon, the Economic Agency of the African territories held by mandate (*Agence Économique des Territoires Africains sous mandat*) now issues a monthly bulletin, the first number of which appeared in April 1924 containing information of an agricultural and economic nature, statistics, shipping news, applications for and offers of posts, and extracts from the principal publications dealing with the region (*Bulletin mensuel d'informations*, 37 Rue Taitbout, Paris)

130 **Special Huxley Number of " Nature "** : — " *Nature* " has published a special Huxley Centenary Number (May 4th 1825-May 4th 1925) to commemorate the centenary of the birth of THOMAS HENRY HUXLEY The special number contains numerous biographical accounts of the great scientist as well as articles dealing with the far-reaching influence of his work on various branches of science (*Nature*, Vol 115, No 2897 London 1925)

131 **The Indian Forester** has celebrated its 50th birthday (1875-1925), No 7, Vol LI, of the periodical is issued in the form of an artistically illustrated jubilee number and contains a number of interesting retrospects relating to the history of forest cultivation in those regions (*The Indian Forester, Jubilee Number* 1875-1925, Vol LI, No 7)

132 " **Italia Agricola** ", the organ of the Italian Federation of Agrarian Consortia, which has its headquarters in Piacenza (Italy) devotes a special number to wheat problems, partitularly those affecting Italy It contains articles by eminent personalities in the agricultural world C DRAGONI : A Brief Survey of Wheat Production and Trade throughout the world , E MORANDI : Italy's Wheat Supply ; A SERPIERI : Wheat growing in Italy viewed from the economic standpoint : V ALPE : Progress of scientific methods in their application to the wheat trade , E AZIMONTI : Wheat Growing in the South ; A. MAROZZI ; Corn, and land reclamation , F. TODARO : Improved varieties and increased production , A DRAGHETTI : Earliness in new wheats ; E. BASSI : Production and trade in selected seeds of crop plants in Italy

133. " **La Terra** " the Italian review which deals with the problem of national reconstruction devotes its eighth number (August 1925) to the difficult

problem of land reclamation in Southern Italy Interesting articles appear on reclamation in the table land of Apulia, in Sardinia, the Ionic Province, and Calabria, on irrigation in the dry districts of Southern Italy, and on the legislation connected with land reclamation. (*La Terra*, Year 1, No 8. Bologna, 1925).

134 **World Agriculture**, the organ of the "World Agriculture Society". U. S. A., has published a special *Czechoslovakia* Number (Vol IV, No 3. 1924, 137-9, East 25th Street, New York). The number contains illustrated articles on the various aspects of agriculture, forestry, animal industry, etc, in Czechoslovakia by Dr V BRDLÍK, Dr F TUMLIŽ, Dr Marie KUKLOVA, Dr. A. MATAUŠEK, Dr V SEVČIK, Dr. J SOUČEK.

Personal.

135. GUSTAVE ANDRE, professor of the *Institut National Agronomique* of Paris has been elected a member of the *Académie des Sciences*, where he will occupy the seat left vacant by prof MAQUENNE. ANDRÉ was a pupil and collaborator of BERTHELOT, with whom he first undertook research work in connection with agricultural chemistry, devoting particular attention to the nitrogen cycle and phosphorus in vegetation and ascertaining the action of magnesium in the functioning of chlorophyl At the IV International Soil Science Conference held in Rome in May 1925, ANDRE gave a successful lecture on "Nitrification and its consequences in agriculture".

136 The science of Agronomics has lost an eminent investigator in ÉMILE CARPIAUX, director of the Station of Chemistry and Agrarian Physics at Combleux He collaborated with prof E LAURENT in the considerable research work undertaken by the latter in the Botanical Laboratory of the well known Agricultural Institute there He was greatly interested in questions concerning the feeding of livestock and the action of biogenic mineral substances. Among his many writings, he is responsible for a study on aviculture, the four editions of which testify to the well merited recognition it met with

137. The death is announced of ADRIEN HALLET, one of the most active and cultured personalities in Belgian colonial circles. An indefatigable worker in the Congo, where he was placed at the head of important colonial companies, and in Malaya where he formed extensive plantations of *Hevea* and *Elaeis*, he had decided to return to the Belgian Congo, there to make use of the valuable experience he had acquired in the Far East, when, after obtaining large grants of land for the *Société des Palmoraies Congolaises* with a view to oil palm growing, his plans were cut short by death.

138. The death has occurred of Senateur PIERRE FOQUET, member of the Superior Forestry Council of Belgium. Senateur FOQUET was the owner of large areas of forest land which he supervised with exceptionally thorough knowledge. 45 years ago he began the progressive afforestation, of the forest of Luchy, which contained large numbers of unproductive cedar trees. Though not a pioneer in this work, he was one of the first to undertake it on a large scale.

139. Dr. WILLIAM T. HORNADAY of the New York Zoological Society has been awarded a gold medal by the International Congress for the Study and Protection of Birds.

140. The High School of Agriculture (*Landwirtschaftliche Hochschule*) of Hohenheim (Germany) has lost one of its most distinguished professors in Dr. OSCAR KIRCHNER, who occupied the Chair of Botany, and whose death occurred on April 25th 1925.

141. The death is reported of Professor H. MAXWELL LEFROY, on October 14, at the age of 48. He was Professor of Entomology at the Imperial College of Science and Technology, London, and had already made a great reputation as an economic entomologist. In 1899 he was appointed entomologist to the Imperial Department of Agriculture for the West Indies, and subsequently became Imperial Entomologist for India. Prof LEFROY published many official papers, and three important books. "Indian Insect Pests" (1906), "Indian Insect Life" (1910); and "A Manual of Entomology" (1923). The silk and cotton industries owe much to him and his advise on the destruction of insect enemies of tropical agriculture has been of great service. His death is attributed to his ardour in research, as he was overcome by gas fumes while experimenting in his laboratory at the Imperial College (*The Times*, London, October, 1925)

142 Prof. BARTOLOMEO MORESCHI, Lecturer on Zootechnics in the University of Rome, and Director General of Agriculture in the Ministry of Agriculture, from 1909 to 1918, has recently died in Rome, at the age of 70.

143. HENRI SAGNIER, permanent secretary of the French Academy of Agriculture has received a noble tribute from the Academy on the occasion of his 88th birth-day. Editor of the *Journal d'Agriculture pratique*, a former collaborator of BARRAL, editor of the *Journal d'Agriculture*, a familiar figure to all those interested in the French agriculture at the present day, SAGNIER may be considered to be a veteran of the agricultural press of the last half century.

144 The death has been announced of Prof. GUNNAR SCHOTTE, Director of the Experimental Forestry Institute of Sweden.

Prof. SCHOTTE, to whose organising ability the Swedish Experimental Institute owes much of its importance, was also well known as a dendrologist, being the author of studies on the origin of forest seeds In accordance with the wishes of the International Union of Experimental Forestry Stations, Prof SCHOTTE carried out experiments in connection with the cultivation of forest seeds, especially as regards the Baltic Pine. Prof. SCHOTTE, died on August 28th last, at the age of 51.

145. The death has occurred, in a small village of the Woevre, at Woel (Meuse), of LEON STEF, the Honorary Forest Keeper, at the age of 68, after a long career as official of the Administration of French Forests. Most of his life was spent in the district of Verdun, among the thick woods which cover the slopes of the Côtes and the plain of the Woevre, on the right bank of the Meuse.

146. The death is announced, at the age of 60, of Dr. JULIUS WORTMANN, professor and former director of the Didactic and Experimental Institute of Viticulture, and fruit and vegetable cultivation of Geisenheim (*Lehr- und Forschungsanstalt fur Wein- Ost- und Gartenbau*).

Prof WORTMANN first occupied the post of lecturer at the University of Strasbourg, and was joint editor of the Botanical Journal (*Botanische Zei-*

tung) In 1871 he succeeded Prof MÜLLER-THURGAU in the directorship of the Experimental Station for Plant Physiology (*Pflanzenphysiologische Versuchs-Station*), connected with the Royal Enological and Horticultural Institute (*Königliche Lehranstalt fur Wein- und Gartenbau*) He published the outcome of his researches in valuable studies on fermentation and plant diseases In 1894 he founded the first German yeast producing station, which was followed by the introduction of courses on fermentation In 1903 he succeeded Prof RUDOLPH GOETHE in the directorship of the Geisenheim Institute mentioned above, which he reorganised and developed He was president and member of various important viticultural associations, and in 1907 refused the post of Director of the Imperial Institut of agrarian Forest Biology of Berlin Dahlem

Dott G A .R. BORGHESANI, *direttore responsabile.*

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CURRENT NOTICES.

The Editor's notes are marked (*Ed.*); the letter *R.* indicates the references to the foregoing issues (Monthly and Quarterly) of the International Review.

ORIGINAL ARTICLES

A PHYTOTECHNICAL STUDY OF A USEFUL WILD BRAZILIAN PLANT.

On the farm land surrounding S. Bento das Lages and Brotas, where the Bahia Agricultural School is situated, a wild plant may be found, growing alike freely on clay and sandy clay soils, as well as on the sandy and stiff soils, called in Brazil " massapé ". The plant is known locally among the peasants and shepherds by the name of " gravitaia ".

It is a member of the family *Amaryllideae,* but is not, though in many respects closely resembling it, the *Carlotea,* or *Carapitaia,* sometimes called of Arruda, which is an Amaryllis proper, but a member of another genus of the same family, viz. the genus *Hypoxis,* the species being known as *Tuber brasiliensis.*

The plants belonging to the family of the *Amaryllideae* have textile, medicinal or poisonous properties, and are often very ornamental. The species here described, besides being ornamental, provides excellent forage for cattle, and also a considerable quantity of edible, sacchariferous tubers. Although some species of *Amaryllideae* may be found in the temperate zones, they are properly speaking tropical plants, and the " gravitaia " which forms the subject of this study is found in the northern parts of Brazil and Bahia where the average temperature is about 24° C.

It is an annual, and non-resistant to drought, but on the other hand resists the cold season and the frosts of July and August. As during the torrid summer heats it only thrives in the shade, it may be regarded as a shade plant.

The best season for sowing is the autumn. The plant was grown by the writer in 1901, 1913, and 1914, and specimens obtained meas-

ured 1.6 m., 2 m., 2.20 m., 3.30 m., 4.84 m., and had from 32 to 36 leaves, 13 centimetres long and 0.034 m. in width.

Owing to the beauty of its flowers, the plant may be grown for ornamental purposes. The outer perianth is rose-coloured, paler on the inner side: the inner perianth is light green with red spots and dashes, the principal vein being of a red velvet colour.

The plant may also be cultivated for its starchy, sacchariferous, edible tubers, of which an analysis will be given later; these as well as the leaves make useful stock feed.

Oxen and horses eat this plant readily and it is apt to be grazed down as soon as found.

With a view to making a complete study of the development of this plant including flowering and fructification and for classification purposes, the writer in April 1902 transplanted a single specimen, found in a wild state, placing it in sandy clay soil with some humus, previously prepared. In the month of August on this single stem thus transplanted there were six well developed shoots and a bud or new shoot. One of the six shoots showed a single flower, while on a bifid shoot there were two peduncles each with two flowers, and on a trifid shoot two, each with three flowers.

The tubers were larger than those produced by the plant in the wild state, when in rare cases only they exceed 0.035 m in length, and 0.025 in width, and attain measurements of 0.047 by 0.034 as shown in fig. 8. The tubers are slightly hairy externally, the leathery xanthophyllous epidermis is covered with a downy, velvety layer or surface of a straw colour.

Classification of the "Gravitaia".

The flower.

The flower (figures 24 and 25) has a double perianth and the stamens and pistil are in the same flower and ripen simultaneously.

The male organs (androecium) consist of six hypogynous stamens with subulate filaments, i. e. thicker at the base than at the apex, as shown in figures 26 and 27 at *a*, *b*, and *g*, where they are represented at three stages of development. Up to the fourth day they differ in size, two being shorter or smaller and four larger or more developed, in other words tetradynamous, as shown in figure 27 at *a*, *b*, and *g*.

From the first to the second day the anthers which are ovoid

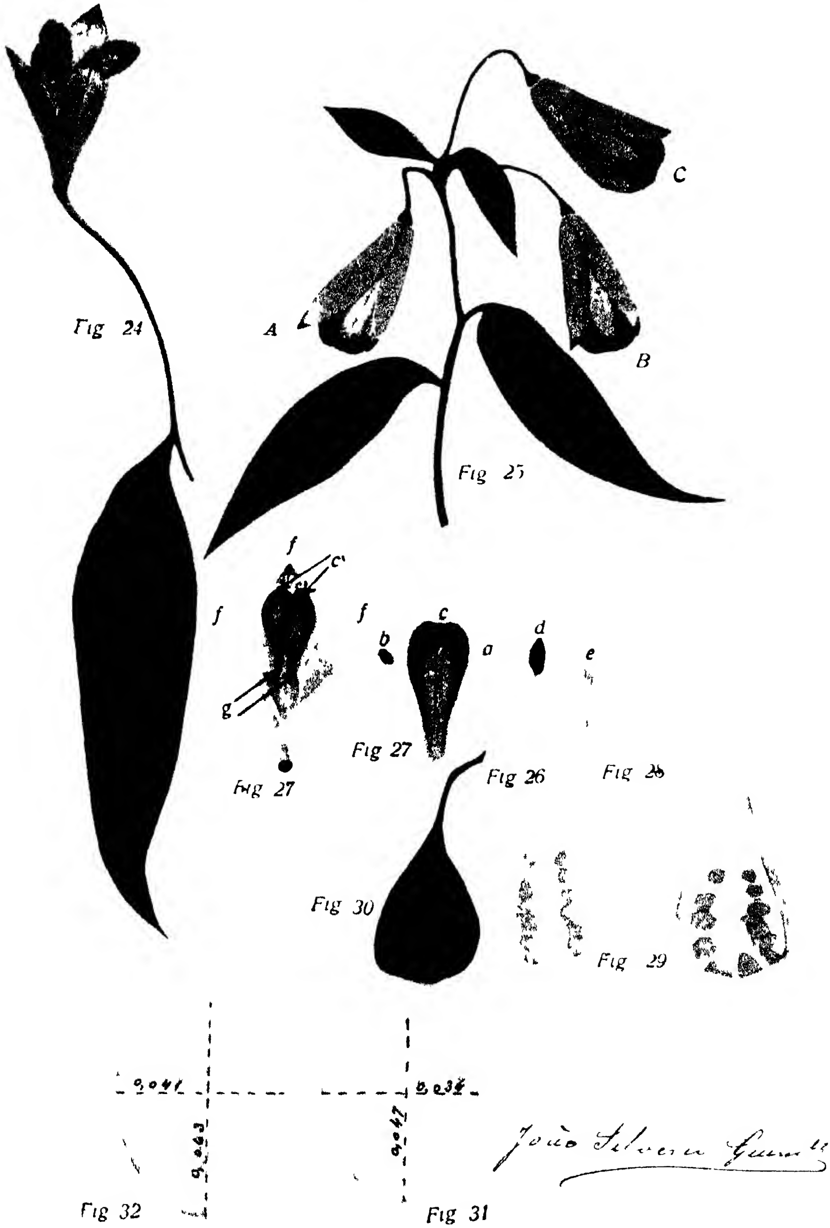

Fig 24 Flower of the « Gravitaia » at the top of its branch, and leaf — Fig 25 - Terminal trifid branch with flower — Fig 26 Stamen in mature state with a dark green anther — Fig 27 - Tepals or perianth leaves, showing inner side and stamens with atrophied anther — Fig 28 - Pistils during fertilisation with trilobate stigma — Fig. 29 Section of fruit showing the arrangement of the seeds — Fig 30 Entire fruit — Fig 31 and fig. 32 - Tubers of « Gravitaia » (dimensions in decimals of a metre)

in form, become dark green instead of yellow, reddish or red. The gynaeceum, pistil or carpel, consists of the inferior ovary, the tubular cylindrical style, and the trifid or tri-lobed stigma, shown in the figure at *e*.

When the pollen is ripe the larger stamens bend over and approach the ovary for fertilisation.

According to the Linnean classification the flower is hexandrous and trigynous.

Figure 24 shows a flower at the apex of a shoot and a leaf.

Figure 25 represents a terminal trifid branch shoot with a flower on each peduncle and four leaves. The flowers, A, B, and C, in figure 2 show respectively the outer floral leaves which are rose-coloured, and the inner ones seen from the front, which are of a yellowish colour, with dark red spots. The third apical flower shows at C the inner perianth or floral leaf seen from the back of a dark green colour spotted like the others Figure 27 shows at C, C', and F the perianth leaves seen as it were from within or from the outer edge ; at *a* and *b* are seen stamens with atrophied anthers. Figure 28 shows the pistil at the time of fertilisation, with the tri-lobed stigma and its sharply pointed lobes as seen at *c*. When these lobes are pollinated, the edges close over.

Figure 26 represents the stamen at time of fertilisation and at *d*, its dark green anther.

The Fruit.

The fruit is an inferior dehiscent capsule, with six divisions or loculi, each containing five or six seeds, orange coloured tending to red, of the shape and size of a pomegranate seed.

Figure 29 shows the fruit cut in section and the arrangement of the seeds, and figure 30 the whole fruit showing dehiscence at point *h*, where the orange coloured seeds are shown. When these ripe seeds fall on the ground they germinate and are the means of reproduction, as well as the tubers which remaining in the soil send up fresh shoots, as soon as the temperature becomes favourable to growth.

TUBERS OF THE " GRAVITAIA ".

Figures 31 and 32 represent the tubers at their natural size, the argest that have been obtained by the writer by cultivation. The

epidermis of the tuber is very tough and leathery or coriaceous, and when the plant is flowering or at flowering time it is of a saffron yellow in colour.

This colouring matter which is insoluble in water or alcohol, is soluble in ethyl ether, and on analysis has been classified as phylloxanthin, both on account of its colour, and from its properties which are identical with those of that substance.

Prior to the formation of this colouring matter in the inner mass of the tuber, a substance of a pale red colour appears similar to erytrophyll or carotin. In the wild state the tubers are from 0.047 to 0.050 m. long and from 0.034 to 0.035 in width (fig. 31) and one plant bears 11 to 15 tubers. On cultivation the writer obtained 23 to 30 tubers measuring 0.063 by 0.041 m. (fig. 32).

The tubers are attached to the extremities of the roots which are fibrous and rigid, about 0.3 long, and resemble the creeping rootstock of the fern, known as " samambaia." A proportion or geometrical ratio or progression exists between the number of tubers produced by a plant and the number of flowers on a shoot.

On a plant bearing five flowers eleven tubers were found; on one with twelve flowers, twenty-three tubers; on another plant fourteen flowers on one spray and thirty-two tubers. A common ratio is to be observed between these three sets of numbers : 5, 11 ; 12, 23 ; 14, 30.

The main stem is much branched, climbing but without tendrils, the leaves are alternate and lanceolate (figs. 24 and 25), of a glossy dark green on the upper side and ash-coloured underneath. On each spray there are from 32 to 36 leaves of 13 centimetres in length and 34 millimetres in width (0.13 by 0.034 m.) the leaf stalk being twisted.

It belongs to the class of the *Liricidae* of Brogniart, to the family of the *Amaryllideae*, to the genus *Hypoxis*, tribe *Hypoxideae*; the name given to the species is *Tuber brasiliensis*, from the country where it is indigenous.

Chemical Composition of Tuber Brasiliensis.

Analysis of the tubers grown in 1901 (1).

Substance of the epidermis	Phylloxanthin
Starch	Asparagin

(1) Plant grown and analysed by the writer in 1901. The results are published in the *Boletim de Agricultura da Bahia*, IV, Vol. 3, March and April 1904, Nos. 3 and 4.

Carbohydrates . .	Polysaccharides	Cellulose Starch
	Monosaccharides	Glucose
		Water
Organic Acids. . .	Oxalic Tartaric Malic Citric Formic (alkaline formate)	

Ash.

The green leaves have very nearly the same chemical composition as the tubers, containing chlorophyll, instead of xanthophyll, nitrogen, water, starch, glucose, potash, acids, etc.

The analysis of the leaves was effected at the same time as that of the stem.

Cultivation of *Tuber brasiliensis* in the Farm Training School of Bahia.

In Brotas.

The experimental cultivation was undertaken a second time in 1913 with a different object.

After the classification and analysis of the plant had been completed, it was decided to make a comparative and analytic study of the quantity of the acids and of the carbohydrates. Different plants were placed in beds of soil in the full light and exposed to the action of the solar heat, and on the other hand in pots, in the shade, in a diffused light and at a lower temperature. Each plant had a space about 0.44 m. wide, and the same depth of soil. The sowing took place in April, i. e. the autumn season in Brazil, and the most favourable for their natural development, and on August 19 they were in flower, as they would be in the wild state.

Condition of the Plants on 19 August 1913.

Bed	No.	1	plants of	five	stalks	of	2.20 m.	each
»	»	2	»	six	»	»	2.20 m.	»
»	»	3	»	three	»	»	3.30 m.	»
»	»	4	»	three	»	»	4.84 m.	»

The plants in beds Nos. 1 and 2 showed, some five and others six flowers and produced 11 and 15 tubers.

The plants in bed No. 3 had some stalks with 12 flowers and produced 23 tubers.

The plants in bed No. 4 showed some stalks with 14 flowers and produced 30 tubers.

The tubers examined contained the same predominant acids : oxalic and tartaric ; starch and glucose, occurring in the same parts of the plant in which starch occurs, also dextrose, in a proportion of 4.44 per cent. The deviation of this latter to the right of the plane of polarisation is about 50 degrees, that is to say it has a right-handed polarisation.

The dextrose may appear on heating by hydrolysis of the starch which breaks up under the action of the acids. In such conditions saccharose cannot be formed, since apart from the invertase (or sucrase), a dissolving diastase, the invertin of the saccharose, the simple presence of an acid is sufficient to set up the inversion of this carbohydrate disaccharide and in so far as the acidity persists it would be impossible to obtain any quantity of this crystallisable sugar or saccharose.

The starch produced by chlorophyll assimilation produces under the action of acids disaccharide maltose which is isomeric with saccharose ; and maltose formed under the action of the same acids is transformed into monosaccharide or dextrose. This appears to be the physiological and bio-dynamic action of these organic compounds. In the higher plants the vegetable acids appear as intermediate between the carbohydrates and carbon dioxide gas, and form the products of incomplete oxidation or respiration

Radiation plays an important part in removing acidity, and an increase in temperature even more so. If the acidified plant is exposed to the sun's rays, the acids gradually disappear.

The direct and intense action of light brings about complete oxidation of the acids, and stimulates the action of chlorophyll, thereby taking a very important part in the removal of acidity. The vegetable acids are products of oxidation or of incomplete respiration, tending to form bodies which are less oxygenated than carbonic acid, which is the final result of the combustion of carbon, and more oxygenated than carbohydrates, the typical form of which is, in the case under consideration, glucose. At a low temperature there is solidification ; at a high temperature the acids are destroyed. The

raising of temperature increases or accelerates respiration, and when this becomes more active, assimilation increases with the growth of the plant and with the formation of new leaves, the formation of reserve material being more rapid whenever synthesis increases. When the oxidation of the glucose is diminished owing to greater respiratory activity, there is an increased production of this carbohydrate, as the quantity of acids is reduced ; if the formation of the acids and of the glucose is physiologically modified, as I conjecture to be the case, by the action of the physical agents, light and colour, it is possible that the reserves of this monosaccharide become concentrated in saccharose or at least that this disaccharide product does not completely break up into dextrose and levulose, in proportion as it goes on forming in the way it probably does. Glucose seems to give rise by concentration or oxidation to acids in the following order : citric, malic, oxalic, formic acid generally appearing in combination. This series of acids is a kind of scale of concentration, of intermediate oxidations between the extremes of the carbohydrates and carbonic acid gas, and in my opinion it is to be attributed to incomplete respiration. It may well happen that from this cause one or other acid is not present at any given moment in the cycle of growth. To ascertain this, the writer grew the plant in the shade and in the full light of the sun, with the object of comparing the results of the respiration activity ; in other words, I attempted to diminish the acidity if not to make it disappear entirely, and thus obtained a certain reserve or production of saccharose. This shows that G. ANDRÉ was quite right when he says in his " Chimie végétale " (1) :

" When plants have a cell sap which is prevailingly acid, they contain little saccharose : it would seem that the condensation of the reducing sugar is counterbalanced by the inverse hydrolysing action which the acids exercise on saccharose ".

Dextrose seems to be the result of the decomposition of the acid or of the saccharose.

When the green leaf is examined during the day, dextrose is not found : if picked and kept in the dark, dextrose appears. Starch on the contrary is present during the day and according to experiments of the writer it is more abundant in the evening up to 11 p. m. than from midnight to 8 a. m.

(1) *Chimie végétale*, p. 143.

Analysis of the Carbohydrates contained in the leaves of Tuber brasiliensis *as grown in Brotas*

2 October 1913 Cultivation in the shade	2 October 1913 Cultivation with complete exposure to the sun
Analysis No 1 Leaf analysed at 5 30 p m Contained starch No dextrose	Analysis No 1. Leaf analysed at 5 30 p m Small trace of starch at edges of leaf No dextrose
3 October 1913 Cultivation in the shade	3 October 1913 Cultivation with complete exposure to sun
Analysis No 2 Leaf examined at 8 a m Complete absence of starch Contained dextrose	Analysis No 2 Leaf examined at 8 a m Small trace of starch in less proportion than in the evening Contained dextrose
3 October 1913 Cultivation in the shade	3 October 1913 Cultivation in the sun
Analysis No 3 Leaf examined at 11 p m Slower decomposition of the chlorophyll Contained sufficient starch » dextrose	Analysis No 3 Leaf examined at 11 p m More rapid decomposition of chlorophyll Contained a larger quantity of starch than the leaf of the plant grown in the shade Contained dextrose

To prevent any challenge of my analysis, I sent to the Professor of Analytical Chemistry at the Bahia Agricultural School, Dr Paul Huart Chevalier, a number of tubers grown by myself in Brotas, so that he might make a fresh comparative analysis of the components, as a check on mine I append the result of the analysis to which he subjected these tubers which in every way confirms the analysis I made in 1901 and again in 1913.

To the letter I wrote on 13 October 1913 Dr Chevalier replied as follows

« I enclose the results of the very brief tests I have been able to make of the material you sent

Reaction with Fehling's liquid	abundant
» » sunflower (sap reaction) . .	acid
Polarisation	righthanded
Glucose in 90 cubic centimetres of sap . .	4 grammes

It is the glucose which is the sugar of the sap that imparts the sweet taste.

Acid. The acidity is due to malic acid, and I have succeeded in recognising malic and tartaric acid.

Starch. We have extracted the starch from the tubers and have obtained a very white starch ; examined under the microscope it shows very fine granules of the same size as those of potato starch and of nearly similar form. It presents the characteristic hylum. In short, cells of this shape are found, figure 33 showing the granule formed by concentric layers ".

FIG. 33 — Section of the grain of stareh of *Tuber brasiliensis.*

As has already been said, in addition to its qualities as a forage plant, the plant is highly ornamental. As a tuberous plant it serves as a chemical and mechanical corrective of the soil, and among other uses the juice of the tubers can be employed for the manufacture of alcohol, and the starch can be extracted and utilised for all kinds of industrial purposes.

The soil best suited for its cultivation is a sandy-clay soil with humus, but it also thrives on sandy soils, sandy-clay and on the clay known as " massapé ".

DISEASES AND PESTS OF THE *Tuber brasiliensis.*

From the observations I have been able to make on the wild types and on plants cultivatéd by myself, they appear to be resistant to the usual diseases of exotic plants, as with the exception of the round spots of a brownish colour which I have observed to appear on some leaves of a few plants after flowering and which resemble rust stains, I have not discovered any pathological symptoms.

The species is without the numerous pests such as infest lucern and other forage plants.

Crickets nibble the young plants down to the ground. Shoots are frequently bitten off by these orthoptera to the height of a decimetre.

The arachnids being insectivorous are not strictly speaking plant pests, but their larvae, though not vegetable parasites, are from time to time found on the underside of the leaves, where holes of irregular shape are formed. Small red spiders about 0.002 m. long often spin their webs over the plant and spoil it. There is also another spider

of about 0.006 m. long, with a greenish coloured body with pink stripes and a straw coloured head spotted black. This arthropod is harmless as it belongs to the order of the muscivors, and it undoubtedly acts as a sort of guardian of the plant, protecting it against the attacks of the diptera which feed on it.

The " sauvas ", the mandioca ants, also bite the leaves of the *Tuber brasiliensis* and are the most troublesome of the pests encountered in its cultivation

JOÃO SILVERIO GUIMARÃES,
Agricultural Engineer, Bahia, Brazil

THE REJUVENATION OF THE ANIMAL ORGANISM.

Introduction

The conception of the possibility of rejuvenating senile animals is not new. The rejuvenating effects of suitably graduated physical exercises have been recorded by Rouhet, Desbonnet, F. Heckel, and others; on the recovery of development in animals subjected to long fasting and then fed intensely, see Morgulis, Goetsch, etc.; on the regeneration of parts lost in lower animals, Schultz, and especially on the renewal by grafting in higher plants, whose lives can be prolonged considerably. But to Brown-Séquard belongs the merit of having pointed out a new way of rejuvenation of the animal organism, by his communication made to the Biological Society of Paris in June 1889, in which were described the effects of true rejuvenation, proved by him at the late age of 72 years, by means of subcutaneous injections of the extract obtained from fresh testicles of guinea-pigs and dogs.

Identical but more lasting effects were subsequently obtained by Steinach, Voronoff and other experimentors, by the tying of the duct of the *vas deferens* and by transplantation of testicles and ovaries of young animals.

The results hitherto obtained have given rise to numerous problems which touch the very essence of biology and the moral and social conception of human life. These should be discussed in relation to their theoretical foundation before being accepted by our imagination, which is too much accustomed to consider as inexorable the vicissitudes of life and death, of youth and age.

Modern views regarding advancing age.

Old age and death have at all times appeared implicit in the very conception of life. Common observation shows indeed that every living species, whether animal or plant, among specific hereditary characters, has that of the duration of life.

But the death of each organism, as it ordinarily happens, can always be connected with external causes which at some time have acted on it. *Natural death*, understood as the expression of the uniform senile atrophy of all the structures of the organism, which leads to the depression and finally to the simultaneous extinction of all functions, probably never occurs, unless (ROBERTSON) the organism is placed in absolutely ideal conditions so as to be safeguarded from all external causes of disease.

The conception of the existence of immortal forms of life among unicellular organisms which reproduce themselves by direct division, now shared by biologists, is due to WEISMANN. According to this writer there is a very essential difference between multicellular and unicellular organisms ; the former are destined to die, the latter, on the other hand, are immortal in the sense that if a unicellular organism does not die from external causes, on attaining a certain size it divides by splitting into two parts, each of which develops and subsequently divides and so on to infinity, without the occurrence of any death.

The immortality of unicellular organisms, in WEISMANN's conception, would be due to the fact that all the organic functions, including reproduction, are collected in a single cell which includes the *mortal soma* and the immortal *germ plasm*. Arrived at the limit of their evolutionary capacity these cells do not perish, nor are they destroyed, but split into new elements.

In multicellular organisms death would be due, on the other hand, to the incapacity of the somatic cells to reproduce themselves indefinitely, owing to which in the course of their evolution they exhaust themselves while the germ plasm, transmitted from generation to generation by means of the gametes, is potentially immortal and unites one transient generation to another.

Objections have been raised to the doctrine of the immortality of unicellular organisms. HERTWIG observed that when a unicellular organism splits into two, even if there is no actual dead body, practically there is the disappearance of an individual existence, which is perpetuated in the descendants, by means of a mechanism profoundly different from that of a multicellular being, but with the same significance. MAUPAS found that the unlimited propagation of unicellular animals by division is not possible without the occasional stimulus of conjunction. He observed that *Infusoria*, after a long series of splitting, suffer a true senile atrophy and perish

unless conjugation takes place. This intermixing rejuvenates the culture and makes it again capable of reproduction by division for many consecutive generations.

The periods of reduced reproductive capacity, observed by MAUPAS and by other writers in the *Infusoria* cultures, were however attributed by LORAND, LOSS, WOODRUFF to the unchanged composition of the medium — *monotony of environment* — and to the gradual exhaustion of the nutritive materials necessary for the nuclear and cytoplasmatic synthesis. Transferred to a new medium the unicellular organisms achieve a real "rejuvenation" because the greater nutritive power of the medium allows the nuclear synthesis which is necessary for division. ROBERTSON has however observed that individuals, isolated from an old, densely populated culture, often show a prolonged lag-period during which their capacity to multiply appears to be so depressed as to render new transplants difficult. In this way irregular rhythms of reproductive capacity may be established in the descendants of a culture, which are really attributable to variations in the conditions of the culture medium at the very moment when the new individuals are isolated for transplantation.

Thus, with a constant renewal of the nutritive medium, there is no doubt that among unicellular organisms multiplication by division except in cases such as that investigated by CALKINS for *Uroleptus mobilis*, can be continued theoretically to infinity. As a matter of fact, WOODRUFF with frequent renewal and variation of the nutritive medium, obtained 8400 generations of *Paramoecium aurelia* in thirteen years, without any loss of reproductive capacity and without conjugation taking place at all.

MÉTALNIKOV experimenting for 10 years on *Paramoecium caudatum* obtained similar results.

The aptitude however, for unlimited multiplication by division is not restricted to unicellular organisms. The somatic cells also, belonging to differentiated tissues, are virtually capable of infinite multiplication. Recent investigations on the culture of tissues *in vitro* have indeed shown that, in suitable experimental conditions, the increase of some differentiated tissues can be indefinitely maintained. CARREL and EBELING for over twelve years cultivated connective tissue *in vitro*, which after 2500 transfers preserved intact proliferative activity and constantly doubled its mass every 48 hours. Epithelial tissue proliferates *in vitro* constantly

every 18 months, and even the thyroid has been cultivated *in vitro* without the cell losing its morphological aspect and its specific chemical activity. JENSEN's tumours have been propagated by transplantation through many generations and have greatly exceeded the duration of life of the host.

As a whole these facts show that, contrary to the fundamental hypothesis of WEISMANN, unlimited reproductive capacity is not only an attribute of unicellular organisms and of germ plasm, but also of somatic tissues. From a strictly theoretical view point, it may indeed be asserted (ROBERTSON) that not only is death not the necessary result of life, but that potential immortality, with unlimited capacity of reproduction, is a universal characteristic of matter.

Senile atrophy, which animal tissues undergo, consists of a series of structural deteriorations and relative feebleness of all the functions of the organism. SALIMBENI and GERY made a study of the tissues of a woman 93 years of age, who died in consequence of acute disease of scarcely 36 hours duration, on which account can be excluded the confusion with special lesions due to disease of long standing. They found widely diffused sclerosis in almost all organs, infiltration of leucocytes, thickening of the glandular tissues, fairly frequent calcification of the arteries, of the choroid plexus and of the spinal medulla ; signs of enfeebled action of the thyroid and of the epiphyses and enfeebled action of the supra-renal bodies, as well as lesions, which were however considered as of slight importance in view of the age of the woman.

Sclerosis, which has a dominating influence in the structural deteriorations of advanced age, has been reduced by METCHNIKOFF to a single type, sometimes affecting the walls of the arteries and sometimes the parenchymatous tissues, or the osseous tissue, or the nervous tissue. In any case there is infiltration of phagocytes, which are mononuclear leucocytes, or fixed endothelial connective, nervous or muscular cells, which absorb the worn out anatomical elements and take the place of these, being transformed into connective tissue.

Senile atrophy might be indeed characterised, in all organs, by gradual substitution of differentiated tissues by hypertrophic connective tissue.

In bones in process of senile degeneration, the tissue of the osseous lamellae is gradually replaced by giant osteoclasts, whence

the *osteoporosis* and spontaneous fracture so frequent in old persons. In the nervous centres it is the cells of the neuroglia which replace the nervous cells, whence progressive weakening of the intellectual faculty and of the coordinating action of the brain on the other organs. In the muscles it is hypertrophy of the muscular cells which reduces the contractile substance of the muscular fibres, whence the muscular weakness of old persons. In the arteries it is the inner coat which is the seat of deterioration : the lesion extends subsequently to the other coats of the walls of the arteries causing endoarteritis, the immediate effect of which consists in decrease of elasticity of the walls and narrowing of the lumen of the artery.

In the course of this investigations METCHNIKOFF was struck by the identity presented by the lesions proper to senile degeneration and by certain lesions due to pathogenic bacilli. Arteriosclerosis especially may occur as a consequence of many infective diseases, *syphilis*, *typhus*, *malaria*, *diptheria*, etc., but also sclerosis of other organs is not infrequent among the after-effects of infective diseases, especially of syphilis, and between a senile kidney and a kidney with interstitial nephritis (BESREDKA) there is, from the point of view of their structure, more than a simple resemblance. Sclerosis in these cases would be produced by *bacterial poisons* which preferably attack the specific cells of the tissues, while the *phagocytes*, more resistent to the action of the poisons, end in absorbing the affected cells and take their place, transforming themselves into connective tissue.

On the basis of the identity of the lesions produced by bacterial poisons and those found in senile atrophy, METCHNIKOFF attributed the latter to processes of a microbic nature and in contrast to the usual conception of the physiological origin of old age, considered advancing age as a disease of late evolution. The origin of the poisons which cause senile sclerosis have been attributed by METCHNIKOFF to the large mass of germs which are renewed daily in the large intestine of mammals.

While circulating in order to be eliminated by the kidneys, the toxic products of intestinal fermentations cause a slow poisoning, the external symptoms of which are precisely those of advancing age. METCHNIKOFF endeavoured to attenuate the toxic effects of the intestinal fermentations by suggesting the ingestion of *lactic bacteria* which, in his view, are strongly antagonistic to other microbic spe-

cies of the intestine, and are less injurious. Recent researches (KOESSLER) have however demonstrated that the flora of the intestine is not substantially modified by the ingestion of cultures of lactic bacteria, nor are the substances thus produced in intestinal fermentation entirely deprived of toxicity.

The analogy established by METCHNIKOFF between the effects of poisons on tissues and senile degeneration may be considered to be correct and the lesions produced by the microbic toxins constitute without doubt an acceleration of advancing age. However, the inmost mechanism of advancing age is not made clear by this ingenious theory of METCHNIKOFF.

MÜHLMANN, referring to the work of ROUX and of LEWES on the struggle for existence between the anatomical elements of the various tissues of multicellular organisms, considered that one of the mechanisms, perhaps the most important, by which the specific cells came to be substituted by connective cells, consists precisely in deficient nutrition due to progressive development of less differentiated tissues. Indeed in a nutritive medium inhabited by cells of higher Metazoa, the latter cease to multiply and to produce new cells when the material becomes insufficient for nuclear synthesis, which is the principal characteristic of growth. The smaller size of the nucleus of the anatomic elements of certain tissues of purely structural importance, renders however their multiplication possible even in nutritive media no longer suitable for the nuclear synthesis of cells with highly developed nucleï, such as nervous cells. The progressive replacement of these cells by others less differentiated then takes place, until the weakness of their function causes the death of the whole association. Thus in the struggle for life the less differentiated cells have an immense superiority over the more highly differentiated cells.

According to T. BRAILSFORD ROBERTSON it is not real deficiency of nutriment which decides the fate of the differentiated cells, but the simultaneous increase in auto-catalytic power, which makes nuclear synthesis impossible for them.

He attributes the progress of the complex process of nuclear synthesis to the progress of an *autocatalytic monomolecular reaction* and to represent its mechanism considers the case of a community of physiologically similar cells — as for instance a culture of Infusoria — in medium the nutritive level of which is maintained constant by introduction of new material at regular intervals.

Nuclear synthesis in each cell of the culture thus tends towards the equilibrium expressed by the formula :—

$$X_{ex} + X_{end} = \frac{K_1}{K_2} a$$

in which X_{ex} represents the autocatalytic power possessed by the nucleus of each cell at the moment of the preceding division, and X_{end} represents that which is subsequently attained in the daughter cells. Suppose that a cell of the community acquires the capacity of dividing its nuclear substance, before equilibrium is reached, when, that is to say, the other cells of the community are still unable to divide, the process of nuclear synthesis becomes more rapid in the new type of cell, because the smaller volume of the nucleus required for division is repeatedly formed. We have thus an energetic nuclear synthesis of an association in which at first it took place much more slowly.

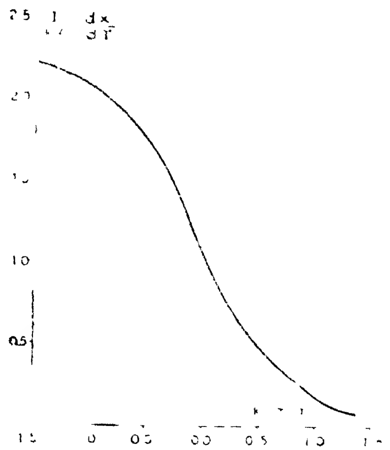

FIG 34 — Relation between the rapidity and the intensity of transformation at different stages of an autocatalytic mono molecular reaction

But the nutritive level assumed as constant, being already scarcely sufficient to maintain equilibrium of nuclear synthesis in the old type of cell cannot, when used to determine a more rapid synthesis in other cells, preserve the equilibrium originally required by the nuclear synthesis of the old type of cell. We have, that is to say, a decrease in the nutritive level for the old type of cell, and a new equilibrium of nuclear synthesis is established which approaches to that which will finally be attained by the new type of cell. The old type of cell consequently is forced to reduce the nuclear size. If this reduction exceeds the limits of its functioning it must then disappear to give place to a new type, but if in the multicellular organism the old type of cell has assumed some functions strictly indispensable to the life of the whole organism, the deca-

dence of such cells causes as an inevitable consequence the death of the entire association.

In the struggle for existence which takes place between the tissues of the higher animals in the period of development and differentiation, the less differentiated tissues constantly tend to render the general conditions of nutrition incompatible with the multiplication of the more highly differentiated tissues, and finally, owing to the reduction of the nuclear equilibrium, incompatible also with their maintenance. Scarcely is the point reached at which the conditions cease to be adequate for the maintenance of certain tissues which fulfil an essential function for the association, when the final fate of the association is sealed.

On the basis of this idea, the accumulation of sclerotic tissues, as age advances, seems to be simply a special case of a vaster phenommenon common to all associations of cells which have to live in nutritive media of reduced volume. And since each cell which divides exhausts its autocatalytic capacity and returns to the initial phase of the autocatalytic cycle, that is to say rejuvenates, ROBERTSON believes himself to have reached by a different path a general theory of advancing age practically identical with that propounded by CHILD. According to CHILD it is the repeated process of multiplication, rather than the low degree of differentiation, which hinders in Protozoa the progressive course of advancing age and death. Each division produces a degree of rejuvenescence which compensates for the advancing age recorded in the interval between divisions. This takes place similarly in the case of higher plants, in which longevity may be attributed to the periodic renewal of the leaves and roots.

The considerable longevity of man, compared with other mammals, according to FRIEDENTHAL, is due to the great development of the nervous system, whence a high degree of resistence to inanition retards the effects of the progressive invasion of less differentiated types of tissues. He has shown that the proportion between weight of brain and body weight raised to a power of $^2/_3$ — factor of cephalization — varies from one animal species to another in proportion to the maximum possible duration of life. In man this duration, calculated on the basis of the *index of cephalisation*, is 80-150 years, which latter limit has effectively been reached in well ascertained cases of extreme longevity.

Further, numerous theories have been formulated regarding

the mechanism of advancing age starting from the idea that life is, in the ultimate analysis, the result of complex physico chemical phenomena. These theories so far are without secure experimental basis. According to LUMIERE advancing age would be due to the fact that the *colloidal* granules, ultimate physical constituents of living matter, augment progressively in volume with age, and consequently have in them a reduction of capacity of adsorption, and therefore of activity, which explains the progressive feebleness of vital manifestations in advancing age. But in consequence of the researches of LOEB and his school, which have shown that the colloids behave like the crystalloids, and follow like these the laws of chemistry, the phenomena of superficies and adsorption attributed to the colloidal state become secondary, compared with the predominant action of molecular reactions.

For others (PICTET) the mechanism of advancing age would consist, presumably, in the gradual transformation of the amino-acids with open chain into cyclic compounds, with consequent profound alteration of the cellular proteins.

A new and suggestive field of research on the study of advancing age was opened by the experiments of CARREL, who has shown the presence, in the blood plasma of young animals, of substances capable of promoting the development of tissues cultivated *in vitro*, while the plasma of old animals is almost free from such substances. The influence of age on the content of the serum in substances which actuate cellular proliferation is so considerable that CARREL and EBELING have proved that there is a definite relationship between the age of the animals which supply the serum and the acceleration of the growth of tissues cultivated *in vitro* The juice of embryonic tissues shows itself to be particularly rich in substances which excite cellular proliferation, while in adult organisms the capacity to produce such substances is only preserved by lymphocytes.

As regards the depression of reproductive capacity of the more highly differentiated tissues found in organisms of advancing age, not to mention the mechanisms already described it seems probable that, at least in part, this should be attributed to progressive diminution of substances which excite cellular proliferation. The connective elements, being less exacting, as shown by experiments of culture *in vitro*, can continue the process of active multiplication, giving rise to sclerosis, even when the quantity of ex-

citing substances, furnished by the plasma, is no longer sufficient to stimulate the proliferation of the anatomical elements of the differentiated tissues.

These substances were called by CARREL " Trophonae ", but as their chemical nature is still unknown, it seems possible that we are not dealing with new hypothetical substances, but with the synergetic action of the hormones normally contained in the blood, which seem to become fewer with age.

This conception furnishes an explanation of the surprising phenomena of regression of sclerosis and renewal of proliferative activity in differentiated tissues, noted during the last few years as a consequence of the grafting of sexual glands in senile animals.

In the following chapters an account will be given of the present state of our knowledge of the physiological properties and the anatomic seat of the sexual hormones, of the biological effects of grafting and finally of the technique of the operation of grafting and other means by which it is possible to bring about rejuvenation.

II.

PHYSIOLOGICAL PROPERTY AND ANATOMICAL SEAT OF THE SEXUAL HORMONES.

The functional relations between the sexual organs and the other systems of the animal organism were noticed in fairly remote times. ARISTOTLE recognised and described the effects of castration on domestic animals, attributing to the testicles a function of great importance for the maintenance of vigour in males. The anatomists and physiologists of the Renaissance also recognised the very marked effects of the sexual glands, and especially of the testicle on the organism. But the testicle being then considered as an amorphous and semi-fluid mass, the secretions of which were derived from the bone-marrow and from the brain, a somewhat imperfect, but expressive interpretation was at that time given to this functional correlation, as is shown in the following passage from the work by SALOCCINI :— " The power and courage of man depends on the testicles, because from these parts issue subtile humours and vapours which mix with the spirits of our blood and of our nervous juices to generate our boldness and our vigour ".

At the beginning of the XVIII. century REGNIER DE GRAAF succeeded in showing that the testicle is formed of sinuous, fine, twisted tubes, in which the semen is formed. But to explain the general action exercised by the testicles on the organism, he admits the contemporaneous formation, in the tubes, of vapours — *aura seminalis* — which are spread through the other organs and cause the appearance of hair, the development of the larynx, and physical vigour. WITHOF, in 1756, attributed the effects of the testicle to the sperm in it which, re-absorbed, would represent a particular *stimulus* for the functions of the entire organism. This idea was later developed and elucidated by BROWN-SÉQUARD who thus expresses himself, after having illustrated the profound modifications produced by castration before the age of puberty :— " These facts and many others, clearly show that the testicles supply to the blood, either by re-absorption of certain parts of the sperm, or otherwise, principles which give energy to the nervous system and probably also to the muscles ".

With the recent development of the doctrine of the internal secretions, the action exercised by the sexual glands on the organism has been attributed to special hormones elaborated by them. Little is actually known of the real existence and the true nature of the sexual hormones ; however, it is possible to study some of their physiological properties indirectly.

The sexual hormones possess the general properties of the other hormones. They possess definite specific anatomical functional and non-zoological properties, since they act in a similar manner whatever may be the animal species which elaborated them. They are without antigenic power and hence they do not even cause phenomena of chemotaxis. They function as regulators of the metabolism of matter and energy without ever supplying energy.

Like the hormones of the thyroid, epiphysis and hypophysis, they exercise also a distinct morphogenetic action, to which is largely due the somatic sexual characters which in some species serve to distinguish the sexes. Of such characters, some — *genitalis subsidiariae* of POLL's classification — relate to the anatomic differences of the internal and external genitals in the two sexes. The others — *extra genitalis* — relate to other special marks and products of the soma, which in many animal species — Chordata, Arthropods, etc. — differentiate at first sight the male from

the female, by their absence or presence and by their different development and shape.

To this category belong some ectodermic organs :— *feathers, hair, teeth*; some dermoepidermic folds and papillae — *copulative papillae* of the Amphibia Anurae, *papillae of the glands* of some mammals, *crests* of tritons and of birds, *fins*, etc.; some cutaneous glands — *interdigital glands* of the Monotremata, *glands of the neck* of the Camellidae, etc. and also some cephalic appendages of Arthropods, and lastly the horns of mammals.

The morphogenetic action of the sexual hormone is also impressed on the osseous system, accelerating the processes of endochondral and periosteal calcification, and on the general development and the length and thickness of the joints, determining in many species considerable differences of bodily size between the males and females. Also the so-called "change of voice" which is observed in man at the period of puberty, and the song of some adult birds, have reference to the morphogenetic action of the sexual hormones. At puberty there is generally increase of volume in the larynx, enlargement and consolidation of the cartilages of the larynx and elongation of the vocal cords. In consequence, in the male, the voice becomes deeper and fuller, and, though in a less degree, also in the other sex it becomes stronger and more flexible. The selective stimulant action of the sexual hormones on the increase of the larynx is shown by the fact that in individuals of the human species, if castrated when young, the voice preserves the infantile tone, and in some animals — cock, horse — also, if castrated late after having been used for breeding purposes there is loss of voice.

The effects of castration, as also the modifications of the soma which follow the senile involution of the genital organs, have now made clear, on an experimental basis, the dependence of the somatic sexual characters on the germinal glands. In castrated animals the epiphyseal cartilages of the long bones remain active for a considerable time causing characteristic modifications of the skeleton and especially elongation of the joints. The internal and external genitals undergo more or less marked atrophy; some somatic sexual characters disappear, others regress and tend to approach the characters opposite to them, and in general the organism partly assumes the characters proper to the infantile stage. Only the Lepidoptera and a few other invertebrates are excep-

tions, as in these castration does not cause marked modifications of the bodily form. The somatic sexual characters, according to HERTWIG, TANDLER and GROSS as well as STIEVE, should be considered, at least in part, as characters of the species whose evolution is stimulated or inhibited, or otherwise regulated, by the internal secretions of the sexual organs.

The method of action of the sexual hormones in morpho-

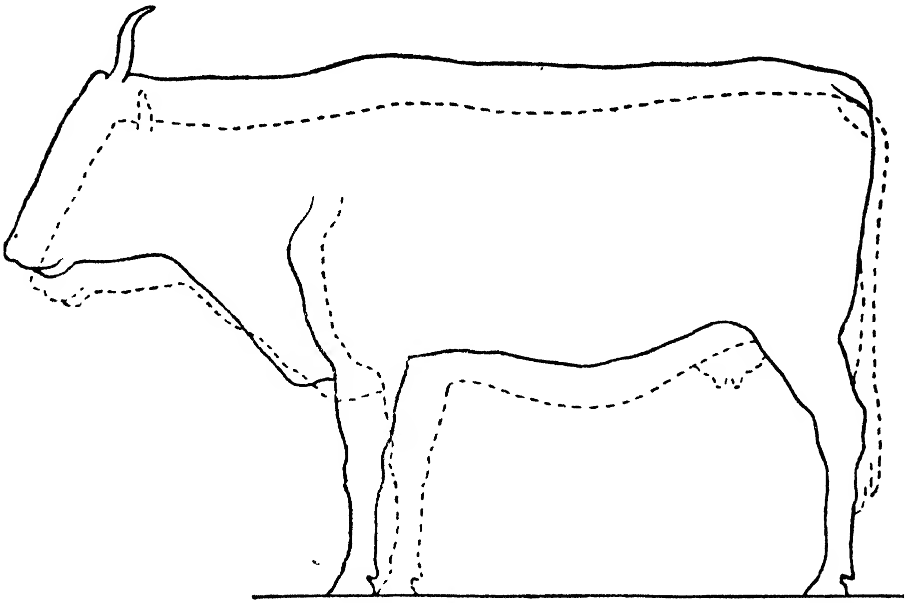

FIG. 35 – Conformation of the normal cow (dotted line) and of the castrated animal (continuous line) TANDLER and KELLER

genesis is still obscure. However, CHAMPY, basing himself on some observations made on invertebrates and lower vertebrates, attributes to the sexual hormones an action essentially qualitative and capable of causing or exciting, in a way analogous to the effect of organic and inorganic catalysing agents in ordinary chemical reactions, the development of the somatic sexual characters; while from a quantitative point of view this development would be conditioned and regulated by the quantity of nutritive substances at the disposal of the organism.

The sexual glands with their internal secretions exercise, also, a definite action on the central nervous system and hence on the psychich life.

This action is made particularly manifest in the human species at the period of puberty, characterised by more or less profound modifications of the intelligence and by a complex of new aesthetic sensations which indicate the unfolding of the sex life.

In frogs the male, at the time of pairing, besides presenting peculiar anatomic and functional manifestations — callosity of the toes, croaking, hypertrophy of the muscles of the arm and forearm — shows a particular tendency to embracing with specialised claws, the so-called *amplexation or copulating* reflex by which it embraces and squeezes even inanimate objects. This reflex disappears with castration (NUSSBAUM, MEISENHEIMER, HARMS, STEINACH) but reappears in the castrated frog if injections are made of pulp of the nervous system of males in heat. STEINACH attributes the action of such pulp to the accumulation of the sexual hormones in the nervous system of males in heat and to the special stimulation which they exercise on the nervous centres and system. The mechanism of this amplexation reflex seems to be rather complex, being dominated by cerebral and cerebellar regulating influences (ALBERTONI, STEINACH and LANGHANS, BAGLIONI, SCHRADER) while it is completed in the medulla. It is, in any case, clearly shown that the nervous system may be directly influenced by the sexual hormones.

MAGNUS HIRSCHFELD, taking as proved the influence exercised by the sexual hormones on the nervous system and formulating the theory of intermediate degrees in sexual manifestations — Zwischenstufentheorie — admits a perfect parallelism between the biological phenomena and the psychic phenomena which relate to the sexual sphere.

He attributes, in fact, a strictly biological origin — deficiency and anatomical and functional anomalies of the genital organs — to psychopathic affections of sex — *homosexuality, androgyny, transvertism, metatrophism,* etc., and in general to all deviations of the sexual instinct which are met with in animals as well as in man With this idea is connected the theory of the potential bisexuality of the sexual glands, by which the direction of sexual activity, and in general of desire, would be determined by the prevalence of the elements of one sex with respect to those of the opposite sex in the early stages of ontogenetic development, both elements being considered as normally present in the sexual glands. The sex of the sexual glands is, however, to be considered as irrevocably fixed at the

act of fecundation and is represented (KOHN) by the germinal cells which they are capable of elaborating.

STEINACH has endeavoured to give a satisfactory anatomic basis to this theory, attributing homosexuality to atrophy of the seminiferous tubes and to the presence in the testicles of homosexuals of large interstitial cells similar to the luteal cells of the ovaries, which he regards as interstitial cells of a female type — *F. cells* —. But this statement was not confirmed in its essence and its signification by many other investigators — HIRSCHFELD, STIEVE, HANSEMANN and BENDA and others. The facts however remains that the surgical cure of homosexuality advised by STEINACH and consisting in the removal of the abnormal testicles and subsequent grafting of normal testicles, in some cases (LICHTENSTERN, MUEHSAM, THTZE-SCHREIBER) has given positive results in the sense that in the individuals operated upon, the return of normal desire has been obtained. Also in women prostitution and deviation of the sexual instinct seem to be bound up in many cases with facts of hyper-ovarism and of hypo-ovarism (VIDONI) or with anatomic and functional lesions of the genital organs due to pathological factors.

In the human species, however, the psychical phenomena which are related to the sexual sphere cannot be regarded in every case as strictly bound up with the internal secretions of the genital organs. Social life undoubtedly helps to increase in man through the abundance of external sensations the stimuli of a sexual nature. And these in turn concur to fix in the nervous system that complex of associations and of reflexes which constitute the psycho-sexual activity. It is however possible to admit in some cases the temporary deviation of the sexual instinct, under the influence of suggestion.

On the other hand, it is necessary to remember that other glands with internal secretions are important also in determining the sexual somatic and psychical characters, and that complicated correlations exist between the sexual glands and the other endocrine glands. Some of these — thyroid, hypophyses, cortex of the supra-renal bodies — are shown to have exciting function on the development of secondary sexual characters, and their action is synergetic with that of the sexual glands; others, on the contrary — thymus, epiphyses — are shown to have inhibitory action on the development of secondary sexual characters. It is found in fact that the thymus in the crisis of puberty rapidly atrophies

to a minimum which persists in advanced age, and that the destruction of the epiphyses causes a rapid bodily growth, while with castration before puberty and in the case of eunuchism, underdevelopment of genital organs, infantilism, etc., there is persistence of the thymus (TANDLER and KELLER). The mechanism of these synenergetic and antagonistic correlations is still obscure, but it is they which determine with their extreme complexity (KEHRER) the "*individual sexual formula*".

Opinions are divided as to the localisation of the endocrinal function of the testicle. ANCEL and BOUIN base their opinions mainly on the great prevalence of the interstitial cells in cryptic and in any way displaced testicles, in which spermatogenesis is suppressed, while the secondary sexual characters and the *vis coeundi* persist in a fairly marked manner in the individuals, and they attribute the production of the sexual hormones to testicular interstitial tissue and by analogy to the ovarian interstitial cells.

This idea was developed and confirmed by STEINACH and by his pupils in a long series of experimental researches on the effect of ligature of the *vas deferens* and on transplanting of testicles. In a testicle the *vas deferens* of which has been ligatured, as also in one transplanted, there occur profound histologic modifications which conduce to the degeneration of the seminiferous tubes, with more or less rapid atrophy of the germinative elements and considerable increase of interstitial tissue. Parallel with the disappearance of the spermatic tissue and the increase of the interstitial, the secondary sexual characters and the psychical characters of sex are heightened, and in the case of individuals of advancing age there is a revival, which may be transitory, of physical power and desire for the opposite sex. Atrophy more or less clearly defined of the elements of the seminiferous tubes and increase of interstitial tissue is found also in many forms of infection, in some forms of serious poisonings, in pathologic atresia of the *vas deferens* and even in chronic diseases with general denutrition. In these diseased states there may sometimes be loss of the *vis generandi*, but the disappearance or reduction of the sexual characters is never observed as a consequence of the regression of the germinal elements. In some cases there may be, on the contrary, increase of sexual excitability.

STEINACH has interpreted these facts as a fresh proof for the endocrine function of the interstitial tissue, to which he has assigned the name of puberty gland — Pubertätsdrüse.

PLATE VII

[illegible]

This conception has been strengthened by the publications of various authors from 1912 to the present time, but the fresh knowledge acquired on the subject excludes, or at least leaves in much doubt, the supposition that the endocrine action of the testicle can be attributed to the elements of the interstitial tissue — LEYDIG's cells. LEYDIG's cells are fairly common in vertebrates and vary from one species to another in quantity, size and form. In some mammals — camel, horse, pig — they are much developed and occupy $^{1}/_{3}$-$^{1}/_{5}$ of the volume of the testicle, in birds they are often small, and in some fishes — Cyprinidae, Salmonidae — and in Amphibia — may be entirely lacking. In the foetal testicle of the higher vertebrates they are ordinarily very abundant, appear some time after the differentiation of the general outline of the generative part and tend to decrease towards birth. At the time of puberty there is normally an increase of interstitial cells with considerable individual variations. There are still greater variations between different species as regards the sexual cycle of adults, especially if it is a case of animal cycle or of intermediate cycle according to the distinction made by CHAMPY.

In many species there is no coincidence between the increase of interstitial tissue and the period of greater sexual activity. In others there seems to be parallelism between the development of interstitial tissue and the spermatogenic activity. In the Amphibia Anurae, FRIEDMANN and MAZZETTI have found coincidence between the greater development of the interstitial cells and the final phase of spermatogenesis. Similar observations were made by HANSEMANN, GANFINI, MARSHALL and others in hibernating animals, in which during *winter sleep* the interstitial cells diminish considerably in volume to increase again with the re-activity of spermatogenesis.

Such coincidences formerly supplied sufficient evidence for ANCEL and BOUIN to affirm the endocrine function of the interstitial cells. At present, however, there is a tendency to attribute a different signification to the variations of volume of the interstitial cells. Meanwhile, for some species it has not been confirmed that there is multiplication and increased volume in LEYDIG's cells in the final phase of spermatogenesis. For others, according to STIEVE, the parallelism between development of the interstitial and spermatogenesis is only apparent and erroneous, because it is necessary to take into account the very considerable variations of the total

volume of the testicle ; it is known, for example, that in the mole, at breeding time, the testicle increases nine times in volume, and larger periodic variations are observed in birds, in which during the breeding season the volume of the organ may increase up to 300 times, and the weight even more. According to STIEVE in the crow, to the enormous variation of the mass of the generative tissue of the testicle, there corresponds, in the same sense, a minimum variation for the interstitial tissues.

Also, as regards the other variations of number and volume of the interstitial cells, noted by ANCEL and BOUIN, by STEINACH, by LIPSCHÜTZ and others, in cases of cryptorchidism, of ectopia, of transplantation, of ligaturing of the *vas deferens*, of radiation with X rays, of general disease, etc., it has been shown that for the most part they are apparent and cannot in any manner be generalized.

In cryptorchid testicles and generally in ectopic testicles, the seminiferous tubes are normally atrophied and the interstitial tissue appears to be increased in volume with respect to the diminished seminiferous tissue. The increase in volume is not however constant, some exceptions having been observed by FELIZET and BRANCA, BRUNI and others. It is moreover probable that the increase is only apparent, due, that is to say, to the atrophy of the generative tissue, the characteristic mitotic appearance which accompanies proliferative cellular phenomena not having hitherto been noted in interstitial tissue. On the other hand some cases have been described regarding subjects with testicles having absolute predominance of interstitial tissue, in which sexual activity (MAZZETTI, DURCK, BERBLINGHER) was strongly depressed or was entirely absent, and the secondary sexual characters were wholly or partly those of castrated animals. In transplanted testicles, as also in those with pathological atresia, and ligaturing of the *vas deferens*, and in those subjected to moderate action of Röntgen rays, there is atrophy of the seminiferous tissue with increase of interstitial tissue and persistence of the secondary sexual characters.

But in these cases as in cases of ectopia of the testicles or of regression of the germinal elements due to general disease or to seasonal dimorphism, according to STIEVE, there is never total disappearance of the epithelium of the seminiferous tubes. Regression mainly affects the germinative elements, which may be destroyed, while the epithelium persists, although reduced to

a single series of indifferent parietal elements and cells according to SORTOLI.

The probable secretive function of this epithelium cannot be denied *a priori*, particularly as, following the strictly morphological criterion, the internal secretive glands also, like those furnished with excretory ducts, should be considered as derived from a covering epithelium in which the epithelial elements acquire particular characters. This is a criterion which cannot be applied to interstitial cells, the probable connective-tissue origin of which is admitted by many writers.

The endocrine function of the epithelium of the seminiferous tubes, in opposition to STEINACH's theory of the puberty gland, is now admitted by numerous writers, including RETTERER, DIAMARE, BOLOGNESI, STIEVE, KENSSLER, CHAMPY, TIEDJE and others, and seems to find indirect confirmation from the fact that secondary sexual characters are also observed in some species unprovided with interstitial cells, as also from the great differences in appearance shown by the interstitial cells in different species, in contrast to the uniformity of structure of true glands with internal secretion and from the coincidence which is observed in animals with seasonal dimorphism between the final phase of spermatogenesis and the manifestation of the recurrent secondary characters.

From a theoretical standpoint there is nothing to prevent the function of the epithelium of the seminiferous tubes being at the same time exocrine and endocrine, and there may also be a heightening of the endocrine function when through special circumstances, for instance grafting, ligaturing of the *vas deferens*, atresia, etc., the external secretive function comes to be suppressed As with the theory of the puberty gland there is no direct experimental proof of the hormonic secretion of the seminal epithelium. STEINACH thought that it was possible to consider the cryptic testicle, as " isolated puberty gland " because composed largely of interstitial tissue. He did not, however, take into account, that whatever may be the predominance of that tissue, extensive tracts of epithelium always remain in the regressed tubes, forming a source of error, when recourse is had to injection of extracts or to grafting of cryptic testicles for the experimental renewal of the specific hormonic function of the interstitial tissue. More rigorous in any case is the technique proposed by BOLOGNESI, who with bilateral resection of the *epididymis* and *vas deferens* has succeeded in obtaining rapid and acute atrophy of the *didy-*

mis, with complete disintegration of the seminiferous tubes and hyperplasia and hypertrophy of the interstitial cells. But the transplanting of the *didymis* with completely reabsorbed seminal epithelium has not produced the reappearance of the secondary sexual characters in castrated subjects, and this negative experimental proof is not without value.

Recently BRUNI has succeeded in isolating the interstitial cells from the testicles of the horse and the ass, by freezing the testicles and cutting broad sections in the microtome and then beating up the sections rapidly and vigorously in water. With such treatment the seminiferous tubes are entirely emptied and the walls with connective tissue and interstitial cells alone remain, as is shown by the microscope. A first series of experiments carried out on castrated rats, with injections of aqueous-and alcoholic-ether extracts of these sections, did not give conclusive results. But in view of the value of the method, BRUNI's experiments ought to be repeated and extended.

In the present state of our knowledge the actual source of the specific hormonic secretion of the testicles is uncertain. An exception perhaps should be made with respect to the interpretation given by ARON to the so-called "glandular masses" found in the testicles of the Amphibia Urodelae. The glandular masses are formed in sacs emptied of sperms and result in a structure consisting of a central part due to the proliferation of SERTOLI's cells and of a peripheral part which has its origin in the differentiation of the connective tissue of the walls of the sacs.

In their genesis and evolution, as in their regression, these organs exhibit perfect parallelism with the seasonal variations of the secondary sexual characters. Such concordance was shown by ARON in numerous experimental researches, from which it is probable that the elaboration of sexual hormones in Amphibian Urodelae is due to the glandular masses of the testicle.

The knowledge acquired of the localisation of the endocrine function of the ovary is worth attention. In the ovary the cells of connective tissue origin, comparable with the interstitial cells of the testicle, have little importance, since they are entirely absent in many species and are never so abundant as those in the testicle, nor do they show as do the cells in the testicle, characteristic variations in volume, consequent on the action of X rays.

The endocrine function of the ovary in higher vertebrates has been attributed by BORN and by PRÉNANT to the *Corpora Lutea*, there being in many cases coincidence between the evolution of the yellow bodies and the appearance of hypertrophic modifications of the uterine mucosa and of the nipples. Later FELLNER, HERMANN and others noted that the therapeutic efficacy of the total extracts of ovaries in menstrual disturbances and in the menopause was due to the presence of yellow bodies in the ovary and their endocrine function has been fully and variously demonstrated by ANCEL, BONIN, FRAENKEL, LOEB, WESTER, BIEDL, UISKOUBINA and by many other investigators. It is probable that the atretic bodies and the so-called "interstitial gland roditory type" are analogous in function with the yellow bodies in view of the close morphological affinity which they have to these latter. The roditory type of interstitial gland, as is known, has no structural analogy with the interstitial tissue of the testicle. Such glands are generally found in the ovary of the Chiroptera, Insectivorae, rodents and of a few other mammals and are essentially constituted of yellow bodies in fibrous regression and atretic bodies.

III. BIOLOGICAL EFFECTS OF GRAFTING.

The biological effects of grafting are shown in all tissues of the animal organism and have a distinct effect on metabolism.

In males castrated and then grafted, there is restoration of secondary sexual characters, increase of muscular tone, thinning down, greater vivacity, return of desire and capacity to accomplish coition with emission of prostatic secretion. Corresponding results are obtained in spayed females; reappearance of female secondary sexual characters lost or attenuated by the effect of spaying, arrest of uterine atrophy, return — in anthropoids — of the menstrual cycle (STOCKER and UNTERBERGER, HALBAN); and with the implanting of the ovary in a suitable position, even pregnancy can take place (C. FOÀ, CHROBAK, GRIGORIEFF).

The grafting of fragments of the testicle in an entire adult male, or the transplanting of the testicle from the normal position to another — autoplastic transplantation — generally produces heightening of the sexual instinct and of the secondary sexual characters — *hypermasculinity*. These effects are more evident in young males under the age of puberty, grafted with mature testicles,

in which cases VORONOFF has observed acceleration of bodily development, precocious appearance of secondary sexual characters — especially hypertrichosis — premature ossification of the epiphysical cartilages, awakening of the sexual appetite. The thorax in these animals is wider, the muscular mass more developed, while a characteristic proportional lesser length of the joints is noted, due to the accelerated process of ossification. Similar effects have been observed in accidental and pathological cases of precocious puberty, by hypertrophy of the testicles (MARRO and SACCHI) or by hypertrophy of the ovary (H. THOMAS and HERSHMANN, HALLER, VEREBELY).

In sheep grafted at a very early age — two or three months after birth — VORONOFF has noted a greater production of wool, the filaments of which became more abundant and considerably longer. In addition they have, *pari passu* with premature appearance of the secondary sexual characters, accelerated in development, which is translated into increase of bodily weight and consequently greater precocity in the production of meat. VORONOFF has endeavoured to give practical effect to these observations, recommending the substitution of castration by grafting, so as to obtain in young males a greater quantity of wool and meat.

It is still premature to give an opinion as to the practical application of pre-puberal grafting in sheep with a view to obtaining in the males an increased production of wool and meat. But the conclusions reached by VORONOFF, as regards the capacity on the part of the grafted males to transmit to their offspring a greater aptitude for wool production so as to be able to fix this character in the descendants in the course of a few generations, cannot be accepted, in view of the uncertain state of our knowledge regarding the transmissibility of acquired characters.

Among cattle, attempts have been made to increase, by means of grafting, the sex impulse in bulls where it is weak. (GRÜTER).

In man and in senile animals the effects of grafting and of other equivalent surgical interventions — homoplastic transplantation, ligaturing of the *vas deferens* — are still more noticeable and include a collection of data of the highest importance in the study of biology.

In senile rats, in which there is normally more or less marked atrophy of the external and internal genitals, thinness, slowness

PLATE VIII.

FIG. [illegible].—Cock in an advanced state of senility (MAYMONE).

FIG. 58.—The same cock, 45 days after the endoperitoneal installation of the testicles of a young cock (MAYMONE.)

PLATE IX.

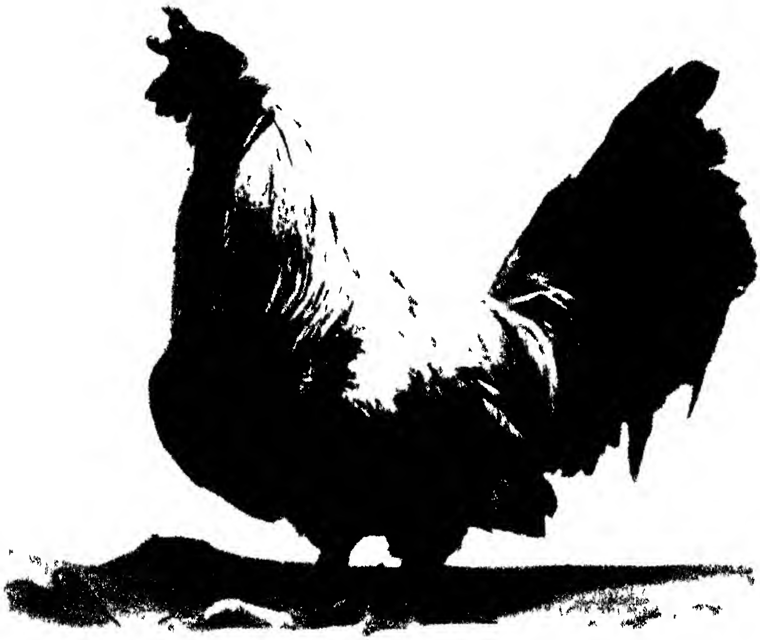

FIG. 39.—The same cock 5 months after the installation of the testicle (MAYMONE).

of movement, visual weakness, sleepiness, deterioration of the bony parts, particularly regarding the curvature of the spine, falling of hair, and frequency of cutaneous lesions due to parasites, STEINACH has obtained, by ligaturing the *vas deferens* and by grafting, a rapid improvement of the general condition, increase in weight, development of the muscular mass, straightening of the spine, regrowth of hair on the parts which had become bald, agility of movement, strong aggressiveness, return of the external genitals to youthful fullness and tone, reappearance of sexual appetite. These results have been fully confirmed in man and in other animals, by many experimentors (STEINACH, LICHTENSTERN, KAMMERER, VORONOFF, BRINKLAY, LYDSTON) and appear to overthrow the conception, hitherto dominant, of the non-reversibility of biological phenomena.

In a very successful case of homoplastic grafting of the testicle in an old cock, which had become thin, almost incapable of standing upon its feet and which for more than a year had lost the power of crowing, I also observed rapid and surprising improvement of the general condition, hyperplasia of the erectile organs for a long time atrophied, return of power of crowing, at first laboured and strident, then clear and powerful, return of the combattive instinct and of the sex impulse

In his experiments of rejuvenation in man VORONOFF had noted, besides the external signs of rejuvenation, a notable improvement of the intellectual faculties, greater resistance to physical and mental fatigue, improvement of sight in long-sighted persons through increase of tone of the ciliary muscles, constant decrease of arterial pressure and in some cases amelioration of the symptoms of *angina pectoris*.

Often there has been, in old men grafted, the restoration of the *vis generandi* due to the restoration of spermatogenesis in senile testicles. But in many cases it has not been possible to conquer impotence by grafting, though the other effects of rejuvenation have constantly been obtained. Some of these effects — increase of tone in atrophied muscles, regression of arteriosclerosis, reawakening of intelligence, etc., etc., are truly surprising and justify a reasonable anticipation of the probable reversibility of some phenomena which characterize the bio-chemical and histological mechanism of old age. On the other hand, it appears probable that the endocrine action of the grafted testicle is explained through com-

plicated correlations and interrelations of secretions, affecting the whole endocrine system, which influence metabolism profoundly, causing, in the composition of senile tissues, nutritive modifications and dynamic effects. The intensification of metabolism in senile animals subjected to ligaturing of the *vas deferens*, or grafting was observed, among others by LOEWE, ZONDEK, VORONOFF and other investigators.

Similar effects are obtained in the case of females grafted with young ovaries furnished with *corpora lutea*.

Rejuvenation of senile organisms can be effected, provided that there are no serious endocrine disturbances or other irreparable pathological phenomena.

The attachment of the graft should be perfect and the piece used must be cut out of a young animal in a state of active spermatogenesis. The main element of uncertainty in rejuvenation lies in the duration of its effects, and the doubt as to whether a real prolongation of life is to be obtained by its means or not

STEINACH in his experiments of rejuvenation of rats, which live on the average for 30 months, has obtained prolongation of life by 7-8-10 months longer than the " control " animals of the same group. On cessation of the effect of grafting or ligaturing of the *vas deferens*, advancement of age was greatly hastened in the rejuvenated rats, indicating that the organism had been subjected by the effect of the rejuvenation, to intense strain.

The experiments of VORONOFF and others on man are still too recent to permit a conclusion to be reached regarding the duration of rejuvenation and the possibility of prolonging it by repeating the grafting on the return of advancing age. However, it cannot be denied that new and very interesting facts may be brought to light by extending the experiments of rejuvenation.

A field in which the biological effects of grafting have seemed to be remarkable is that of the crossed and heterosexual graftings. Grafting in castrated males of ovaries containing yellow bodies, if the graft holds, is noted by the intensification of the atrophy of the male genitals — penis, prostate, seminal vesicle — and pari passu increase of development of the nipples and the appearance of some secondary sexual characters proper to the female sex (STEINACH, KUND, SAND, STEIN and HERMANN). The males so femalised offer reflexes of enticement for normal males and are sought after by the latter like females. The development of the

nipples is, in many cases, so considerable as even to show stimulation of the lacteal secretion. In young females spayed and then grafted with testicles — masculinisation — there is marked regression of the uterus, of the nipples, development of the bony parts and of the muscular mass, similar to that of normal males, considerable hypertrophy of the clitoris and appearance of secondary sexual characters proper to the male sex. The psychical behaviour resembles that of the males, they follow the normal females and fight with the males (STEINACH, PÉZARD). Heterosexual grafting has greater probability of success in subjects castrated before sexual maturity. In the uncastrated the attachment of the heterosexual genital body seems to be hindered by the presence of the genital body of the host (STEINACH, SCHULTZ, C. FOÀ). The transplant often remains without effect in the invertebrates (MEISENHEIMER, OUDEMANS, PRELL). By grafting contemporaneously testicles and ovaries in castrated guinea-pigs and rats, STEINACH, has succeeded in producing true *experimental hermaphroditism*, which by the distribution of the somatic characters of the two sexes differs considerably from bipartite gynandromorphism, and approaches to the rare cases of natural hermaphroditism.

In artificial hermaphrodites, the stature, the bodily development, the disposition of the hair are influenced by the secretion of the testicle and assume male characters, development of the nipples — often rather marked — takes place influenced by the ovary, and the psycho-sexual behaviour shows itself variable, with periods of erotism of a male type and others of a female nature.

Another order of effects — hormonal sterilisation — has been obtained by HABERLENDT by grafting under the skin in female guinea-pigs or rabbits, ovaries of the same species in a state of pregnancy. In the subjects operated upon, the impregnated yellow bodies have produced effects of inhibition of ovulation more or less intense, which perhaps may have important clinical applications.

Included in the biological effects of grafting are also the attempts at surgical cure in homosexuality and in other sexual psychopathies.

In the experiments of grafting it was observed by HOUSSAY and LIPSCHÜTZ that very small fragments of testicle were capable of ensuring in the grafted animals the normal development of the secondary sexual characters. These researches renewed by PÉ-

ZARD with the aid of exact quantitative determinations of the degree of development of the erectile organs of turkeys, have led him to conclude that there is no parallelism between the mass of testicle grafted and the degree of development of the sexual characters governed by the internal secretion of the testicle. Thus, beyond the point at which the internal secretion begins to be sufficient to cause the development of the sexual characters there would not be quantitative relationship between increased secretion and the development of the sexual characters.

According to PÉZARD the endocrine function of the testicle would be responsive to the *law of all or none*, already recognised as true by MAREY for the cardiac muscle, the range of contraction of which is independent of the intensity of the stimulus, a maximum of contraction being found combined with a minimum intensity of the stimulus, and by VERWORN for the nervous fibre.

LIPSCHÜTZ in his experiments on guinea pigs and mice has proved that very small fragments of testicle, corresponding to 1-2 % of the testicular mass, are sufficient to assure the normal development of the sexual characters in grafted animals CHAMPY has verified the applicability of the *law of all or none* in testicular grafting of frogs, and ZAWADOWSKI in birds. However this law does not lend itself as a satisfactory explanation of hypermasculinity and of eunuchism, and has not been entirely confirmed by STEINACH, VORONOFF, ARON and others.

An attractive field of enquiry is that dealing with the possible action of the internal secretion of the grafted generative tissue on the germinal cells of the host organism, and, in the case of total homoplastic grafting of the ovary in connection with the uterus, the chemical action of the host organism on the grafted ovary. We already know how difficult it is to influence the germinal cells by the action of external factors during the process of maturation, in the organs which envelop them. This difficulty represents the best defence of the species for the maintenance of specific characters and at the same time a fairly strong barrier to attempts at the creation of new species.

In the higher plants, well defined variations of general nutrition and specific variations have been noted, through the effect of grafting. But the transmissibility, when multiplied by seed, of the specific variations obtained by grafting, cannot yet be con-

sidered as definitely ascertained. The variations of general nutrition are shown by the increase and reduction in the normal development of the species to which the graft belongs, according to the stock used, with increase or decrease of volume of the fruit, of the content of saccharine matter, of acidity of mineral salts, etc. Thus, for instance, *Pirus communis* grafted on the quince tree — *Pirus Cydonia* — usually gives larger and sweeter fruit of a colour different from that obtained by grafting the same variety on pear stock from seed. The specific variations are still more significant and relate to the structural and botanical characters. Grafting *Licium barbarum*, a perennial plant with woody stem, on *Solanum lycopersicum*, an herbaceous annual plant, the stock itself becomes woody and perennial.

Other variations concern resistance to certain diseases, communicated by the scion to the graft; thus, e. g., the outbreaks of "gummosis" which seemed about to destroy the crops of *Citrus medica* v. *limonum* in Europe, could be effectively controlled by grafting this plant on *Citrus aurantium* v. *Bigaradia*, which shows notable resistance to "gummosis" and communicates this property to the graft.

Lastly, the so-called grafting hybrids, constituted by shoots which for the most part originate from the callus closing the wound of the graft, are of interest. These present the characters of the two individual plants superimposed and fused in a mosaic of elements of variable disposition — the septorial, periclinal chimerae and hyperchimerae of WINKLER.

The analogy between animal grafting and plant grafting is not, however, close, whether because in the latter there is constantly arterial anastomosis, or on account of the different distribution of the germinal cells in the animal organism and in plants. Certain experiments would however suggest the possibility of influencing animals by external stimuli of the germinal cells in such a way as to cause the appearance of variations in the descendants.

Putting aside the classical experiments of HERTWIG, who succeeded in causing in the descendants the appearance of anomalies by irradiating the sperma of frogs with Röntgen rays, HART's experiments are specially interesting. He succeeded in transmitting to the descendants a new form by means of extirpation of the thymus in the parents. GROTE, again, reports that by feeding white

mice, before mating, with thymus, he obtained in the young a distinct inhibition of development in the first weeks of their life, and that in mice born to parents fed with extract of the thyroid gland he obtained a greater development than normal. The possibility of influencing the germinal cells by the action of the glands with internal secretion is also confirmed by TANDLER, and from this point of view homoplastic and heteroplastic grafting of sexual organs constitutes a valuable method of research.

IV. THE IMPROVEMENT OF OPERATIVE TECHNIQUE AND THE SURVIVAL OF THE GRAFTED TISSUE.

The first attempts at grafting testicles date from remote times. Already in 1767 HUNTER, studying the differential sexual characters between male and female in domestic fowls, had attempted to graft the testicles of the cock on the hen; these researches were renewed in 1849 by BERTHOLD, who succeeded in transplanting the testicles of the cock into the peritoneal cavity of capons, obtaining the reappearance of the secondary sexual characters, lost through the effect of castration. There followed the confirmation by WAGNER in 1851, and by NUSSBAUM, MANTEGAZZA, HERLITZKA and SALACHAS, as regards frogs and of LODE, FOGES and PÉZARD, as regards birds.

On account of the greater difficulty which it presents, grafting of testicles in mammals was carried out later by MAXIMOW, RIBBERT, MAUCLAIRE, ZALACHAS, CEVELOTTO, STEINACH and others, Grafting of the ovary, successfully attempted by MEISENHEIMER in frogs, was subsequently applied in human surgery to lessen the effects of spaying in women by MORRIS, UNTERBERGHER and PAKOW, and in animal species for research purposes. The operative technique of grafting, in recent years, has made considerable progress, especially through the work of VORONOFF. The possibility of the success of heteroplastic graftings has been widened and attempts even made to reconstruct the dissected spermatic channels.

The ligaturing of the *vas deferens*, radiation with X-rays and the injection of testicular and ovarian extracts have also been largely used for the exaltation of the sexual instinct and for rejuvenation.

The great difficulty in the case of the attachment of testicular grafts in mammals lies in the impossibility of ensuring

arterial anastomosis so that the grafted piece is supplied with a normal flow of blood in its new seat. CARREL has succeeded in obtaining anastomosis of the arteries in some grafts of entire organs — kidneys, thyroids — made on dogs and cats. But for the testicles the difficulty is almost insuperable, owing to the rather narrow calibre of the arteries, and it is necessary to be content with ensuring a rich supply of plasma for the nutrition of the grafted piece, until with the establishment of adhesion there is a re-establishment of the peripheral capillaries. Starting from this idea VORONOFF proposed to make the graft within or over the serous coat of the testicle, suitably scarifying the seat so as to cause a plentiful extravasation of blood and to stimulate the formation of adhesion. For the graft he preferred fragments of testicle in which it is easier to assure nutrition with plasmatic exudation and with establishment of capillary circulation, rather than the entire organ — the total grafting of the testicle of LIDSTON, ENDERLEIN, LICHTENSTERN, THOREK — which often results in rapid necrosis.

The other methods suggested for grafting differ essentially in the seat — subcutaneous connective tissue, peritoneum, muscular tissue — in which transplantation has been done. LYDSTON has transplanted entire human testicles into the *scrotum*, practising grafting of the *vas deferens*. LESPINESSE grafted fragments of testicles on the *rectus* muscles of the abdomen, ENDERLEIN on the *subcutaneous connective* tissue of the abdominal region, MORRIS on the *sheath* of the rectus muscles, LICHTENSTERN on the raw surface of the *oblique external muscle* of the abdomen, GREGORY in the *recess* between the superior and inferior oblique muscles of one side and the transverse muscle of the other, THOROK directly on the *peritoneum* below the abdominal muscles, and in the peritoneal cellular muscles, by means of a lumbar incision similar to that made for nephrectomy.

The attachment of the graft has varying probability of success according as it is a case of autoplastic and homoplastic transplantation, or of heteroplastic transplantation. In the former cases which deal with tissues belonging to the same autoplastic organism, or with individuals of the same species, the transplant has greater probability of success. However to improve the conditions of attachment in autoplastic grafts, STEINACH advises transplanting the testicles in the peritoneum and in the abdominal muscles leaving them

in contact with the spermatic cord for some days to assure the vitality of the organ in its new seat.

The heteroplastic grafts are difficult of attachment owing to the limited chemical characteristics of animal organisms. In the human species heteroplastic grafts with ram's testicles have been attempted with some success by STANLEY and KELLER and FALCONE, and grafts with testicles of anthropomorphic monkeys by VORONOFF and DARTIGUES. The latter have given a high percentage of attachment and have been suitable for practical application, owing to the great biological affinity between human blood and that of the anthropomorphic monkeys. In the transplantation of sexual glands, as direct anastomosis of the blood arteries is absent, it is not possible to get true, definitive attachment of the grafted organ or tissue, which sooner or later becomes reabsorbed and replaced by connective tissue of the host. Embryonal tissues alone appear to be capable of definitive attachment preserving their own structural and specific characters — HARRISON, BRAUS, SPEMANN.

The duration of the secretory activity of the grafted fragments of testicle, hitherto observed, has been about 10 months for the heteroplastic transplant in rats (STEINACH), which live on the average for thirty months, and three or more years (VORONOFF) for Etero-plastic grafting in man, with testicles of anthropomorphic apes. The possibility of obtaining longer survival with improvements in operative technique is not, however, excluded. RETTERER admits that in the fragments of testicle grafted, only the superficial strata, impregnated with nutritive plasma, continue to live, while the deep strata, in which all circulation is interrupted, suffer rapid necrosis and reabsorption. In the superficial strata, through the effects of the changed conditions of nutrition, the constituent anatomic elements, especially the epithelial cells, change their structure and their evolutive cycle. The epithelium of the seminiferous tubes continues at some points to produce small nuclei and heads of spermatozoa, but the greater part is transformed into a mass of cytoplasm containing numerous nuclei, which develop by successive cellular divisions, forming a reticulated connective tissue of narrow mesh full of translucent plasma. Subsequently the meshes may become wholly or partly empty of plasma.

RETTERER attributes to the production and reabsorption of

PLATE X

FIG. [illegible] — Section of a buck's testicle one year after instillation (KETTERER)

this plasma elaborated by the epithelium of the seminiferous tubes, the influence exerted by the grafted testicle on the other tissues of the organism, but regards the increase of volume of the interstitial tissue as merely apparent since he has never observed proliferative action in LEYDIG's cells.

STEINACH has, on the other hand, observed in grafted testicles rapid disintegration of the seminal epithelium, followed by considerable hyperplasia and hypertrophy of the interstitial cells. This statement was confirmed by numerous investigators, but it is probable (BOLOGNESI) that the disintegration of the seminal epithelium is the reabsorption of the seminiferous tissues which have arrived at the maximum degree of atrophy, rather than a true necrobiotic process caused by the lesion of the grafted organ. As regards the increase of the interstitial cells, at least in many cases, it must be admitted (STIEVE) that it is a case of relative and not absolute increase.

In ovaries grafted subcutaneously in the abdominal cavity there is as a rule early atrophy of the immature follicles and formation of fibres of interstitial tissue. Cases are however not lacking in which the maturation of some follicles and even pregnancy are obtained, if the graft has been made in a suitable seat

The interruption of the spermatic channel by resection or by simple ligaturing of the *vas deferens*, causes, according to ALESSANDRI, ANCEL and BOUIN, STEINACH, MARTINI, SAND, TANDLER and GROSS, atrophy of the testicle, reduction of the calibre of the seminiferous tubes, degeneration and disappearance finally of epithelial tissue and *pari passu* considerable hyperplasia and hypertrophy of the interstitial cells. As a consequence spermatogenesis goes on decreasing until it completely ceases.

According to RIBBERT, FABBRIS, MARCHI and DIAMARE, UFFREDUZZI and others, the ligaturing of the *vas deferens* does not always cause atrophy of the testicle and consequent suppression of spermatogenesis. MARRASSINI thinks that, by itself, ligaturing the *vas deferens* would not produce considerable atrophy in the testicle. This would, on the other hand, be due to lesions caused while isolating the *vas deferens* from the surrounding connective vascular-nervous sheath which latter should not be included in the resection. It is known, that without interruption of the spermatic channel, there may be considerable atrophy of the testicle and degeneration

of the seminiferous epithelium due to the ligaturing in mass of the arteries of the funicle and to the resection of spermatic plexus and that of the *vas deferens*.

GUIZZETTI has shown, on the other hand, that in some congenital anomalies with occlusion of the *vasa efferentia* the seminal epithelium can reconstitute itself normally and produce active spermatogenesis. The histologic modifications, which are found in testicles with interrupted spermatic channels, are generally due to the compression exerted by the sperms inside the tubes and to slow reabsorption by lymphatic channels. The effects of the compression (STIEVE) vary according to the age of the seminiferous tissue. In young testicles in active spermatogenesis, the compression exerted in the tubes by the arrested secretion may be strong enough to cause intense degenerative action at the expense of the seminal epithelium, while in testicles of the old with depressed but not entirely extinct spermatogenesis, the moderate pressure which is established by the effects of the occlusion of the *vasa efferentia* excites spermatogenesis and reactivates the endocrine function of the tissue.

Histologic modifications, similar to those caused by ligaturing the *vas deferens* are also obtained with moderate exposure to X-rays — C. SCHMIDT, ALBERS, SCHÖNBERG, BERGONIE, TRIBENDEAU, VILLEMIN, KYRLE, TANDLER and GROS.

In the case of testicles exposed to irradiation there are more or less profound modifications of the epithelium of the seminiferous tubes, especially at the expense of the elements of the seminal tract, spermatogonia, spermatocytes, cessation or diminution of spermatogenesis and considerable increase of the interstitial cells. If the irradiation is moderate, the epithelium easily regenerates the elements of the seminal tract, probably at the expense of some spermatogonia which have escaped destruction, and spermatogenesis may be reestablished. If on the contrary the irradiation has been excessive, SERTOLI'S cells also, which are the most resistant of the epithelial elements to the action of the rays, end by being destroyed, and there is complete loss of spermatogenesis (KYRLE) while the interstitial cells become hypertrophic and show greater resistance. The irradiation of the ovary is at present widely used for the cure of climacteric disturbances in women by HALBERSTÄTTER HEINEKE, BOUIN, ANCEL and VILLEMIN, TRIBENDEAU, SIMON, STEINACH and HOLZKENCHT, BIEDL, STIEVE and others. In the

ovary subjected to moderate exposure there is cessation of ovulation, regression of the immature follicles with formation of black bodies and persistence of the yellow bodies. In a corresponding manner the irradiated females show hypertrophy of the uterus as in pregnancy, considerable development of the nipples accompanied in many cases with lactic secretion and exaltation of sexual instinct. Similar effects might even be obtained in senile females in whom the considerable improvement of general physical health indicates a true and genuine rejuvenation. A still more decisive simplification of the proposed rejuvenation treatment might be obtained by substituting for surgical operation the injection of testicular and ovarian extracts, already suggested by Brown-Séquard in the classical auto-experiment, which was the forerunner of opotherapy. Opotherapeutic treatment might find its reason for existence and the probability of wide practical application, in the fact that the specific action of the sexual hormones, as in the case of all known hormones, is essentially anatomic and physiologic, and not zoologic.

The introduction of compound extracts of testicles and ovaries, even if cut out with due aseptic precautions, is not however free from serious risks. In the extracts, apart from the non-antigenic hormone extract there are contained numerous antigens with a certain degree of toxicity represented by the protein of the anatomical elements and by products of their autolysis. These antigens, independently of the effect produced by the sexual hormones, can exert an action of their own, masking and modifying that of the hormone. The toxicity of the extracts will be further considered from the point of view of the phenomena of anaphylaxis which may occur and from the point of view of the cytolysis produced which might exert a widespread injurious action on the elements of the live organ corresponding to that from which the extract was taken. It is perhaps due to the great complexity of the effects produced by the extracts that the results obtained with their administration have not always been consistent.

In very successful cases of injections of testicular extracts in castrated individuals (Nussbaum, Dor, Maisonneuve and Meurides, Pézard), and of injections of extracts of ovaries with yellow bodies in females (Fellner, Hermann, Aschner, Okintschitz and Gavin) the reappearance of lost sexual characters was obtained, as by transplants. The action of the extracts is however of

very short duration and disappears with the cessation of their administration. It should not, however, be forgotten that with improvement in the technique of preparation of the extracts their toxicity may be reduced and they may be rendered more effective and constant in their action, as has already happened for other opotherapeutic preparations largely used in clinical practice. Essays in this direction have been made by PARISER with the manufacture of " Rejuven ", by BERTARELLI with the manufacture of " Inter ", and by others. But the results obtained up to the present are not very reassuring. The knowledge obtained shows that the mechanism of old age, though still hypothetical, may be attributed to progressive exhaustion of reproductive capacity of the anatomical elements of the differentiated tissues.

The grafting of regenerative tissue in animals of advancing age, and the other operations capable of stimulating the endocrine function of the sexual glands, undeniably cause a transitory stage of rejuvenation, which can be prolonged by improvement of the operative technique and by repetition of the grafting, but of which the effects on the economy of the senile organism have not yet been sufficiently defined. The mechanism of rejuvenation is obscure; it may however be considered probable that the sexual hormones cause directly or indirectly the synergetic action of other endocrine glands and of special nervous reflexes, having as a final result considerable increase of metabolism and renewal of proliferative activity in the anatomical elements of the differentiated tissues.

In the field of general biology the grafting of generative tissue constitutes a valuable method for experimental research on interesting problems which relate to hermaphroditism, sexual neutralization, acceleration of development in the period previous to puberty and especially the possible effect of the grafted tissue on the hereditary characters of the germinal cells of the host.

Dr. BARTOLO MAYMONE,
Lecturer at the Royal University and Director of the Experimental Zootechnical Institute, Rome.

NEW TENDENCIES IN THE GENETIC IMPROVEMENT OF LIVE STOCK.

It is evident that the improvement of living beings cannot be attempted without a knowledge of the complicated problems of their variations and inheritances which form nowadays a new and important branch of science known by the name of GENETICS under its two aspects, relating to plant and animal life. It is also evident that living beings transmit to their progeny the characters which we call hereditary But here already it is necessary to make a distinction. All that is constitutional is hereditary, if we may say so ; thus for instance the nose, with man, the lungs, the kidneys, etc. This kind of inheritance, which might be called a constitutional one, does not concern us, in a general way. But within it there exists a new kind of heredity, since the form and even the size of the nose may be hereditary (as will happen in the cases of hereditary giant and dwarf characters), although such, size and form may not be hereditary if obeying as wellknown and as universal a phenomenon as is variation or fluctuation. For many observers this problem constitutes a stumbling block when, while not sufficiently distinguishing one case from another, they claim to fix in the offspring a character not hereditary, as being a product of external conditions, which only modify living beings from an individual and never from a hereditary point of view.

So that if in selecting we choose as a norm the most frequent variation which is that produced by the surroundings, we should make the serious mistake which is made by the greater part of those who write on Zootechnics.

This *non-heredity* of variations or fluctuations which is now admitted by the most important biologists, gave the deathblow, twenty years ago, to that theory of evolution which was propounded first by Lamarck and then by Darwin and popularised by them.

Accordingly, it is an error to believe that it is possible to select live stock by the well-known methods of Kramer, Lydtin etc., which consist in taking numerous measurements of the animal, all of them subject to non-hereditary variations or fluctuations. No improvement can be expected in the progeny by this method.

As a matter of fact it is not possible to admit that any animal

will be more useful, or that e. g. a cow will produce better and more milk, if its measurements coincide more and more with the theoretical scale of the maximum of points.

Any one could prove the uselessness of such relations in the measurements of the animal (1), because they correspond to a simple fiction as to the value of correlations.

The modern research work on the phenomena of correlation in animals — executed with a mathematical exactness hitherto unsuspected — cannot recognise the conclusions which were too hurriedly adopted in reference to the criteria here under discussion. I can guarantee that in the Dairy Cow Test organised by me at Ribadeo in June 1924, the cows which obtained medals as the best producers of milk and butter would not have won a single medal if the method of classification had been employed which is based on the bodily measurements of the animal. And it must besides be kept in view that there were 16 competing cows; that the test lasted for eight days; that each of the three daily milkings and also the stock feeds were tested in an exceedingly precise way... The North Americans are used to say with much acuteness in this respect that perfection of form in a cow is not an obstacle to her producing much milk..

I am far from denying the positive utility of an external examination of the animals. It is evident that a good dairy-cow must have fine udders and that a brood mare meant for reproduction must possess the necessary width of frame required by her function.

No one, of course, can deny this contention, but surely the estimation of these characters should not be exaggerated, as it is well known that there are cows with very fine udders that, notwithstanding, give very little milk, and exceedingly well built mares that produce a small offspring So that *a posteriori* we may always be sure of taking a reasonable view of the problem, whereas, if we proceed *a priori*, we cannot be sure.

(1) One of the first to raise his voice against the so-called method of measurements and points was the German professor E. Pott who, as early as 1889, published an immense work — mentioned in the bibliographical notes inserted at the end of this article — which more than ever serves to prove the unrivalled acumen of the German author, violently attacked though he was by his contemporaries. The following paragraphs are taken from this most important book. He says: "Who can prove or believe that the only wel lbuilt Dutch bulls are those which have a trunk length of between 185 and 195 cms., with a uniform height of 142 to 145 cms. from the back to the rump, and a chest depth of 80 to 85 cms. together with a chest breadth of 60 cms?..".

The following words too are worth consideration · "No doubt the stock-farmer may by means of the measurement method obtain some external resemblances in his herd, but will these resembling animals show the same resemblance in their functions?.."

No doubt the ideal achievement would be to combine perfection of form with a high economic value of the animals, and selection and breeding should be carried on in this sense. I believe, however, that it is more necessary to obtain first of all the perfection of the function, instead of looking for perfection of form, and that after having selected certain animals for their functional qualities, one may then begin to look for all sorts of imaginable beauties....

In certain cases beauty of form has a certain economic value which should not be ignored here. Such a case is that of "fancy-horses" — every day less in demand, however — which must, as far as possible, possess special external qualities. It cannot be denied that in this case beauty of form is to some extent hereditary (though not all the progeny of well-built sires are well-built themselves), as it is well known how rigorous a *selection* is made of these animals, in our Andalusian regions, for instance Besides, since the efforts expected from horses of this kind are always less than their actual powers, only a certain standard is as a matter of fact looked for. The end desired is not that of a minimum functional organic yield, as in most other cases, and therefore the harmony of the animal's measurements plays a most important part in its valuation.

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Modern zootechnical tendencies take no account of imaginative theories and are based entirely on data derived from the experimental field, because in positive science nothing counts in comparison with facts themselves rightly interpreted — *facta et verba*..... The strictness of method achieved by investigators is a wonderful thing and the severity with which they sometimes judge their own work is admirable. Hence this modern science of Genetics carries with it extraordinary guarantees.

The improvement of our live stock may nowadays be undertaken, thanks to the discoveries made in plants by Mendel and by Johannsen, those great names of present day Biology. The methods of operation are identical for plants and for animals apart from the differences established by Nature.

In order to state on general lines the method of procedure, it is advisable to keep to one example which, for greater interest, may be taken from cattle. Let us assume that the selection is undertaken with a view to milk yield.

To this end it is necessary in the first place to keep under observation a large number of animals, the more the better. The aim of this observation is to effect milk records, which is not an easy matter. By these milk tests the quantity of milk given by a cow from the 72 hours following calving to the end of its lactation period is recorded and the fat content in the case of each animal is tested.

The experimental facts justifying milk tests may be expressed in the following way:

1. The examination of external characters does not furnish a correct criterion for estimation of milk production.

2. High milk yield is much more an individual quality than a matter of racial heredity.

3. High milking aptitudes are capable of transmission by inheritance.

The first step, thus, is to establish milk records. A true system of milk records registers the entire lactation.

There are, however, various ways of carrying out these tests by which partial data are obtained. As none of these methods are free from error, in each case the method most suited to the particular case should be ascertained. I have seen the control carried out in Belgium, in Switzerland, in France, in Germany and in Italy in very different ways, and though this is not the place to give a detailed account of the technique, it should be said that while in some localities the milking control is effected in the American way over seven consecutive days, in others — as happens in Belgium — it is considered sufficient to register three series of daily milkings: at the end of the second month of lactation, at the end of the fifth month and at the end of the eighth.

The tests can also be carried out in the farms by collecting all the animals, or on the small holdings by going from one to the other and doing the milking and weighing of the milk and taking at the same time the samples for its analysis. Both methods are employed according to local circumstances.

It seems natural to obtain more reliable data in the farm on account of the greater number of safeguards and because the control of feeding can be done under better conditions. In a general way and when the control must be done from house to house a person of approved character must be chosen as tester. To make him acquainted with his duties is a question of a few days.

Let us now suppose that we have chosen the best cows of a

rural zone ; what remains is the more arduous part. The sire is still to be found who can conveniently be mated with the chosen dams so that the progeny may be what we are looking for. Nor can this choice be made in an arbitrary way, i. e. by simply measuring the body of the animal. It must, on the contrary, be done *a posteriori*, experimentally, and here the rules are difficult to state, because in every case the experimental proofs will have to be adjusted to what the person aiming at the improvement thinks suitable. I myself have learned that one must keep in direct touch with realities in order to ascertain and to overcome the numerous difficulties presenting themselves. It is not possible, for instance, in our case, to judge any sire of less than four years of age. To be convinced of this it is enough to calculate the time passed between the first service by the bull and the first lactation of his progeny. As the cows chosen may belong to at least two different categories according to their being pure dairy cows (which is not probable) or to their possessing a milking value due to hybridisation (which is the most frequent case with cows which have won prizes in milking competitions) the aim of the experiments made with the sires will be to verify these extremes Therefore it is impossible here to specify the suitable method, which besides would be a task of some magnitude.

There is, however, a rule for recognising a bull which is the bearer of good aptitudes : namely, when the daughters of this sire are better milkers than their dams, we may almost certainly affirm that the increase of milk or butter is due to the sire. But this does not absolutely hold good in a general way, for reasons which it would take too long to explain. We may now consider that the groundwork of our zootechnical system is laid, and yet the greater part is still to be done, because at this moment there begins the real work of the specialist in Genetics, a work which evinces amazing skill and conscientious care in its progress and its results. Now is the moment to proceed with the consanguineous matings which fix the characters, to arrive at the pure lines which are the goal of our efforts.

Here too is the moment to discard many prejudices cherished by the general public as regards consanguinity. This is perhaps the strongest lever at our disposal for the improvement of animals and plants. Consanguinity creates nothing in progeny, neither for good nor for evil, as is generally maintained nowadays. Consanguinity is the "biological sieve" that severs what is useful from what is harmful,

for consanguinity does nothing else. To this might be objected that there exist numerous cases which prove the harm done by unions effected between kindred, but the answer may be given that there exist just as many which prove the contrary, though it is but logical that the former cases should attract more attention.

Moreover, just as the laws of heredity were mathematically formulated by GREGOR MENDEL, it is curious to observe that in studies upon consanguinity numbers play a most important part. A large part of the higher mathematics which we study in our Engineering Schools is perhaps much more applied to the study and practice of consanguinity than to current engineering. If we add that in Genetics the theory of probabilities is indispensable, it will be understood how great a complexity is involved in these problems.

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The following resolutions were presented to the first Congress of Regional Economy at Lugo by Don Cruz A. Gallastegui, Director of the Biological Mission of Galicia, under whose direction I studied, and myself. They were approved without discussion.

(1) It is of the first necessity to undertake the improvement of live stock if we want to compete on the markets of meat and, particularly, of milk products.

(2) With the present State organisation of mounting stations — for horses, swine, cattle, etc. — the problem cannot be solved.

(3) To obtain the improvement of our live stock it is necessary to have establishments in which large numbers of live stock may be handled, or to transform the existing ones.

I do not think that the foregoing conclusions will be a surprise to any one. As a matter of fact the first of them contains a truth only too evident to all, as it proclaims the necessity of the improvement of live stock. As to the second conclusion, it is easily seen that with the present mounting stations the methodical practice of consanguinity is made impossible, not only because the genetic constitution of the dams is not known, but also because the sires brought from outside the station are more numerous (1). The ideal thing would be that any one sire should only serve the females belonging to the same pure

(1) HAUSHALTER is right in saying that it is no use to import breeding animals descending from dams yielding six thousand and seven thousand litres of milk, if the offspring do not yield more than two thousand litres.

line, as, in this way, the progeny could be absolutely guaranteed. And this consideration is the necessary link leading to the last conclusion, because it means that the farmer must be furnished with the sires and dams which suit him, already selected. It is illogical to furnish him with selected seeds and to deny him the same facilities with live stock where selection is much more difficult.

But what seems an entirely justifiable desire can only be attained if large numbers of live stock can be handled at one time, and this for two reasons: firstly so as to obtain a greater number of selected animals as a starting point, and secondly because, as soon as the characters are fixed, there will exist a considerable number of animals to be assigned to the farmers. Our actual farms do not, for want of means and of working facilities, possess more than twenty or twenty-five head of cattle, an absurdly small number if any improvement is to be achieved. It might be objected that the Basque Provinces have succeeded in improving their cattle stock by means of mounting stations. This is true in so far as they have supplanted the breed of their own country by other animals that give more milk and more meat. But by the method they have followed of crossing the Basque red cows with the sires from Schwyz they have only achieved an apparent uniformity, because in their cattle there may be observed anew considerable differences in the economic aptitudes, not only in precocity, but also as to milk yield which shows that the speedy improvement of the breed under scientific direction should be undertaken. By following a better method the Basques would now have had an improved indigenous stock which they might exploit simultaneously with the selected breed which would best have suited their requirements.

In the province of Santander the mistake made comes from the method followed — though it is quite different from that employed by the Basques — in that, together with the males, they imported numerous females. These cows, called *ship cows*, come directly from the Netherlands.

It is a proved fact that these imported cows are excellent milkers and that their daughters are much less so, whereas their granddaughters produce still less milk than their mothers. The breeders of the province of Santander, following, no doubt, the opinion of some technician, believe — erroneously — that this "degeneration" or diminution of milk production is due to a phenomenon of influence of environment hereditarily transmitted in a progressive way. It

is not to be wondered at if the belief in this error lasts on, as it is simply due to a superficial and ordinary conception of the problem. The Santander breeders believe, in a general way, that the *ship cows* are pure animals, because they are of the same breed, distinguished by a definite uniformity of exterior — colour and skeleton, chiefly. They do not imagine that beneath identical external characters there really may be numerous animals entirely different as to their capacities. But there is still more : the *ship cows* are hybrid products of the first generation — giving to this expression its scientific sense — and as such they present the characters of hybrid strength — in this case, increase of yield — well known to any beginner in Genetics. And so it is only natural that in mating these first generations imported from the Netherlands, Mendelian disjunction — not reckoned with by the Santander breeders — occurs, giving rise to offspring of less milking value.

Even if the imported animals were homozygotic, it must be remembered that they would not all be so in regard to the same characters, and then if two different homozygotic animals were mated, the offspring would be hybrid, which would lead us back to the preceding case.

So the necessity becomes evident of knowing the genetic formula of every animal in order to be able to regulate in every single case the matings which cannot be left to arbitrary solution.

Correct breeding methods would prove that the so-called " degeneration " is one of the numerous myths which disappear when the problems are presented in their real terms.

The foregoing statements simply show that in the Netherlands the breeders know how to provide the markets with animals which are good producers of milk but bad producers of offspring which enables them to make an easy and lucrative profit, a fact to which we are still blind in Spain.

If it is certain that the improvement of live stock and of plants can only be achieved by putting into practice the experimental teaching of modern Genetics, it is readily understood how small must be the value of all that is being preached or written outside the range of this science.

Hence arises the necessity for exercising official action on zootechnical establishments with proper direction so as to avoid useless waste of time and money.

RAMÓN BLANCO,
Chief Engineer of the Agricultural Section of Lugo, Spain

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INTERNATIONAL ASSOCIATIONS

PROCEEDINGS OF THE INTERNATIONAL SOCIETY OF SOIL SCIENCE

Papers.

INFLUENCE OF MANURES AND MICRO-ORGANISMS ON H-ION CONCENTRATION IN THE SOIL.

According to theories expounded by Professors LORENZ and LARMOR, the constitution of chemical atoms is that of a positive centre, surrounded by a considerable number of electrons, the algebraic sum of the electric charges of the atom being zero It has been suggested that these electrons gravitate round the centre and constitute a system similar to a collection of planets gravitating round a star. Cannot what has been said of the atom be said of the molecule ? In the case of a molecule of benzene, for example, do we not conceive a system of many centripetal forces whose resultant is zero ? Any such striking analogy between the planetary system and the molecular microcosm is perhaps equally applicable to the difficulties of study of these two extremes.

General chemistry and especially analytical chemistry have rendered inestimable services to society far exceeding any anticipations formed when these sciences were still in their infancy. For some years the study of solutions, thanks to Arrhenius' theory of electrolytic dissociation of molecules, has given rise to a new branch of chemistry which consists in measuring the H-ion concentration of these solutions. This new branch of science has undergone great extensions in Germany, Denmark and especially in America.

In the New World, where practical realisation of discoveries and inventions is effected much more quickly than elsewhere, the determination of Hydrogen ion concentration constitutes a very convenient and very precise means either for preparing media of microbe culture, or for controlling or estimating various industrial solutions.

Hydrionometry can also give valuable indications to agriculture. An account will here be given of the result of research, the agrochemical deductions drawn from them, and of a new hydrionometric method.

A number of works exist in English on this subject, but there is little in French, either original or translated. Leaving the literature aside, some considerations of a theoretical and technical kind may be reviewed.

A. — Theoretical considerations.

According to Arrhenius' theory, salts in aqueous solution are more or less completely dissociated into ions. Acids are salts of hydrogen and bases are salts of hydroxyl.

A solution of a weak acid HA, contains " active " H and A ions, and "potential" ions contained in the non-dissociated mass H A. The state of equilibrium between H and A on one side and H A on the other is expressed by the equation

$$\frac{(H^+)\ (A^-)}{(H\ A)} = Ka \qquad (1)$$

where Ka is the constant of dissociation and indicates the strength of an acid; (H^+), (A^-), (HA) indicate simply the concentrations of the ions H, A, and of H A during equilibrium. If this acid is titrated by a base, the equilibrium is constantly broken and re-established, until the H ions are completely exhausted as shown by the indicator. While acidimetry has the object of measuring the " normality ", that is to say the total amount of the " active " and " potential " H of an acid, hydrionometry on the other hand only measures the " intensity " of an acid, that is to say the " active " H ions of the solution. Hence we must distinguish between the factor of " quantity " of an acid and that of the " intensity " of the same acid.

Every solution, whether acid, neutral or alkaline, contains H and O H ions; the reaction is neutral if $(H^+) = 10^{-7}$ at 22° C. in gramme ions per litre, acid if $(H^+) > 10^{-7}$ at 22° C. in gramme ions per litre, alkaline if $(H^+) < 10^{-7}$ at 22° C. in ions gramme per litre.

Water though very slightly dissociated contains about one gramme molecule of H and O H ions per ten million litres.

In pure water $(H^+) = (O\,H^-)$ which enables us to write

$$\frac{(H^+)^2}{(H\,.\,OH)} = Ke \qquad (2)$$

$(H\,.\,O\,H)$ being practically constant,

$$(H^+)^2 = Ke.\ (H\,.\,OH) = K_w, \text{ and}$$
$$(H^+) = \sqrt{K_w} = 1.006 \times 10^{-7} \text{ or } 10^{-7}$$

whence $K_w = 10^{-14} = (H^+)\,.\,(OH^-)$.

If in a base $(OH^-) = \frac{N}{100}$ that is to say 10^{-2}, (H^+) will equal ·

$$(H^+) = \frac{10^{-14}}{10^{-2}} = 10^{-12}\ N.$$

Chemists seldom exceed dilutions $\frac{N}{100}$ of acids or bases, every interval included between 10^{-2} and 10^{-12} escapes acidimetry and alkalimetry.

In practice (H^+) is expressed as a function of

$$\log \frac{1}{H^+} = \log \frac{1}{Ka} + \log \frac{\alpha}{1 - \alpha} = pH,$$

a formula derived by the algebraic development of equation (1) and where α indicates the percentage of dissociation of (H A). The notation pH was introduced by SORENSEN and represents the common logarithm $\frac{1}{(H^+)}$.

pH varies inversely with the H ion concentration.

(H^+)	pH
10^{-0}	0
10^{-1}	1
10^{-2}	2
= =	=
= =	=
10^{-13}	13
10^{-14}	14

The buffer action. — This is the resistance offered by a solution to change of its pH by addition or loss of an acid or a base. This resistance varies with the solution as well as with the base or acid added to it.

Determination of pH. – Two principal methods are distinguished, namely, the electrometric method and the colorimetric method. The former gives accurate results, but it is more difficult to effect.

The colorimetric method, slightly less exact than the former (maximum error pH 0.2), can however fully satisfy ordinary requirements, that is, of course, if the necessary precision is observed. It is based on the fact that each indicator has its own zone of change comprised between pH 0 and pH 14. This zone of change, relatively narrow, is characteristic for each indicator. Thus phenolphthalein changes at p H 8.3 and gives a salt completely dissociated at pH 10.0, owing to its neutralisation. The zone of change of this weak acid (phenolphthalein) is therefore comprised between 8.3 and 10 0.

An indicator is a weak acid or base and consequently feebly ionised. Its neutralisation gives rise to a neutral salt which is then strongly dissociated and radiates two kinds of light that which results from absorption is coloured and comes from the interior of the solution, the other, on the contrary, is reflected by the surface of the solution and is generally white light (Ostwald). The shades of a colorimetric scale are due to relatively small differences in the wave lengths of the reflected light.

Measurement by titration only makes use of the extreme colours of the zone, while hydriononetry, by means of type solutions whose pH is previously determined, fixes and utilises the intermediate stages.

B. — Technical considerations.

Type solutions. — The greatest precautions must be taken in their preparation. This is how Clark and Lub's type solutions should be prepared :—

Phthalate $\frac{M}{5}$. Dry at 115° C. $KHC_8H_4O_4$ $\frac{M}{5}$. 40.836 gr. per l.

KCl $\frac{M}{5}$. Recrystallise 3 or 4 times and dry the crystals for two days at 120° C.

KH_2PO_4 $\frac{M}{5}$. Recrystallise at least 3 times in distilled water and dry at 115° C. to constant weight.

H_3BO_3 $\frac{M}{5}$. Recrystallise several times in distilled water and dry in a dessicator with $CaCl_2$

Na OH $\frac{M}{5}$. Boil distilled water in an Erlenmeyer vessel to drive off the CO_2, cool, add sufficient ethylic ether to form a layer 4 or 5 cm. thick and throw in carefully some metallic Na cut up into small pieces. The Na O H which is formed at the expense of traces of water contained in the ether, passes slowly through the layer of ether and is thus kept from carbonisation. Siphon and dilute quickly to $\frac{M}{5}$.

HCl $\frac{M}{5}$. Distill HCl to 20 % and dilute the distillate to $\frac{M}{5}$.

The tables below show how by mixing these solutions it is possible to obtain a whole series of standards.

$$\frac{M}{5}\ KHC_8H_4O_4 + \frac{M}{5}\ NaOH \text{ (at 20° C.)}$$

pH								
pH = 4.0	50 c.c.	$\frac{M}{5}$ $KHC_8H_4O_4$	+	0.40 cc.	$\frac{M}{5}$ NaOH	— Dilute	to 200	c.c.
4.2	»	»	»	3.70	»	»	»	»
4.4	»	»	»	5.70	»	»	»	»
4.6	»	»	»	12.15	»	»	»	»
4.8	»	»	»	17.20	»	»	»	»
5.0	»	»	»	23.85	»	»	»	»
5.2	»	»	»	29.95	»	»	»	»
5.4	»	»	»	35.45	»	»	»	»
5.6	»	»	»	39.85	»	»	»	»
5.8	»	»	»	43.00	»	»	»	»
6.0	»	»	»	45.45	»	»	»	»
6.2	»	»	»	47.00	»	»	»	»

$KH_2PO_4 + NaOH$

pH = 5.8	50 c.c.	$\frac{M}{5}$ KH_2PO_4 +	3.72 c.c.	$\frac{M}{5}$	NaOH	Dilute to	200 c.c.
6.0	»	»	5.70 »	»	»	»	»
6.2	»	»	8.60 »	»	»	»	»
6.4	»	»	12.60	»	»	»	»
6.6	»	»	17.80 »	»	»	»	»
6.8	»	»	23.65 »	»	»	»	»
7.0	»	»	29.63 »	»	»	»	»
7.2	»	»	35.00 »	»	»	»	»
7.4	»	»	39.50 »	»	»	»	»
7.6	»	»	42.80 »	»	»	»	»
7.8	»	»	45.20 »	»	»	»	»
8.0	»	»	46.80 »	»	»	»	»

$H_3BO_3 + HCl + NaOH$

pH = 7.8	50 c.c.	$\frac{M}{5}$ H_3BO_3	$\frac{M}{5}$ KCl	2.61 c.c.	$\frac{M}{5}$ NaOH	— Dilute to	200 c.c.
8.0	»	»	»	3.97 »	»	»	»
8.2	»	»	»	5.90 »	»	»	»
8.4	»	»	»	8.50 »	»	»	»
8.6	»	»	»	12.00 »	»	»	»
8.8	»	»	»	16.30 »	»	»	»
9.0	»	»	»	21.30 »	»	»	»
9.2	»	»	»	26.70 »	»	»	»
9.4	»	»	»	32.00	»	»	»
9.6	»	»	»	36.85 »	»	»	»
9.8	»	»	»	40.90 »	»	»	»
10.0	»	»	»	43.90 »	»	»	»

Clark and Lub's indicators.

Zones of change		Concentrations
3.4 – 4.6	Bromphenol blue	0.04 %
4.4 – 6.0	Methyl red	0.02 %
6.0 – 7.6	Bromothymol blue	0.04 %
6.4 – 7.0	Bromocresol purple	0.04 %
6.6 – 8.2	Phenol red	0.04 %
7.2 – 8.8	Cresol red	0.04 %
8.2 – 9.8	Thymol blue	0.04 %

Test tubes. — In order that the results may be as precise as possible, tubes of white glass should be used of uniform thickness and diameter, otherwise there is risk of comparing the solutions under conditions of varying thickness which would be a cause of error. With this object we have instituted a practical and precise " solenometrical " (1) process. The apparatus required consists of a

(1) From the Greek solene = tube.

graduated test tube of 100 c.c. and a drop measure. The test tube is filled to 80 c.c. and the tube to be examined is plunged into it so that the bottom of the tube is level with the 50 mark of the test tube.

The level of the water then reaches a certain height above the 90 mark. The tube withdrawn takes away a little water which is restored by means of the drop measure.

Out of 300 tubes tested about 30 caused the water to rise to the 95 mark and 20 to the 94 mark.

It is evident how much the tubes differ one from another. The test tube to contain the earth filtrate should be of the same capacity as the scale tubes.

Filtration. — The theoretical and practical details will be found in all books on analytical chemistry.

The filtration of clay soils is not always very easy. The fine particles of colloidal clay easily pass through ordinary filter paper. Filtration on a double filter or by decanting only aggravates this difficulty. We have always obtained very clear filtrates by rapid agitation of 10 gr. of soil with 50 c c. of distilled water, then pouring the whole quickly, but adroitly, on to a folded filter paper.

In this way the pores of the paper rapidly contract. The particles which are deposited on the filter paper itself also play an appreciable part in clarifying the filtrate. The first filtrates will be turbid, and should be collected in a vessel specially prepared. A dozen filtrations can thus be accomplished in 20 minutes.

C. — RESULTS.

1. *Action of manures on the pH of the soil.* — For this research thoroughly prepared ground has been available: the experimental plots of Prof. JOURNÉE of the Gembloux Agricultural Institute. We took a first sample from them during very cold weather, a factor unfavourable to bacterial activity. Although these plots are of the same geological formation and are subject to the same surrounding influence, the different distribution of manures in the various plots has resulted in a special ionic character for each plot where for more than 10 years the same kind of manure and the same doses have been applied for the production of the same crop.

TABLE I. — *Species grown : — Kidney bean.*

Plots		pH
1.	Without manuring	7.45
2.	With 100 k. Na NO_3 / 500 k. Superphosphate	7.00
3.	With 100 k. $NaNO_3$ / 300 k. K_2SO_4	7.30
4.	With 500 k Superphosphate / 500 k K_2SO_4	7.20
5.	With 100 k. $NaNO_3$ / 500 k. Superphosphate / 300 k K_2SO_4	7.15

2. *Effect of aërobic micro-organisms on the pH of the soil.* — As might be expected the influence of manures on the (H^+) of the soil is therefore certain. Will it not also modify the bacterial condition ? Biogenic factors are necessary to the higher plants in the same manner as to bacteria, and it is known experimentally at the present time that manures have an influence on these lower organisms. We shall see that the latter in turn influence the pH.

The same samples of soil subjected to a temperature of 26° C. for 48 hours, with a constant relative humidity, altered pH in very sensible proportion.

TABLE II.

Plots		Initial pH	Final pH	Difference	Yield per *are*
1.	Complete manuring	7.15	6.60	0.55	25.833 Kgs
2.	Without nitrogen	7.20	6,50	0.70	30.833 »
3	Without P_2O_5	7.30	6.90	0.40	24.166 »
4.	Without K_2O	7.00	6.90	0.10	15.833 »
5.	Without manure	7.45	7.10	0.35	23.333 »

(The species grown was the Kidney bean. The last column shows the yields per *are* of the ligneous matter of the Kidney bean).

What is most striking is the parallelism of variation of the yields and that of pH, the numerical importance of which for each plot measures the bacterial activity of the latter. The yield of a soil therefore depends on its richness in aërobic micro-organisms.

The soil is not merely a mixture of humus and mineral substances, but also pre-eminently a living medium.

The relative acidification of all the plots should also be noted, due, no doubt, to respiratory loss by the aërobic micro-organisms.

* * *

The taking of another sample on a very sunny warm day has given the following results :—

TABLE III.

Kidney bean

Plots		Initial pH	Final pH	Yield per *are*
1.	Complete manuring	6.6	6.50	25.833 Kgs
2.	Without nitrogen	6.5	6.25	30.833 "
3.	Without P_2O_5	6.8	6.80	24.166 "
4.	Without K_2O	7.0	6.90	15.833 "
5.	Without manure	7.1	6.60	23.333 "

TABLE IV.

Potatoes.

1.	Complete manuring	. . . .	6.6 (Initial pH)
2.	Without nitrogen	500 k. Superphosphate . . . . 300 k. K_2SO_4	6.5
3.	Without P_2O_5	400 k. $NaNO_3$ . . . . 300 k. K_2SO_4	6.8
4.	Without K_2O	400 k. $NaNO_3$ . . . . 500 k. Superphosphate	6.9
5.	Without manure	. . . .	7.25

Here the influence of solar heat on the pH of the soil by the agency of micro-organisms is manifest, giving results practically identical with those which have been obtained with artificial heating in the course of our experiments, an identity which shows the practical importance of the laboratory work done.

The figures of final pH in Table III were obtained after incubation of 60 hours under a temperature of 32° C. The new variations are smaller, but in the same sense as those of Table II.

The relative smallness of these variations is due to the difference of temperature on the days on which the samples were taken.

The acidifying action of the aerobic organisms is again confirmed. The plot without nitrogen was most acidified, which agrees with PLUMMER's results. (The $NaNO_3$ indirectly basifies the soil by the Na_2CO_3 generated. Since the $NaNO_3$ is the only basifying manure, except lime, it is fully intelligible that its favourable effect should be so manifest on the crops).

3. *Effect of anaërobic micro-organisms on the pH of the soil* — If badly aerated and water-logged soils are especially rich in strictly anaerobic micro-organisms, this should not be the case with healthy, well aerated soils where the anaerobic flora should property consist mainly of potential anaerobes, and to a secondary extent, of anaerobes in the strict sense. Apart from this hypothesis which is the logical one we should find a difficulty in interpreting the figures obtained which are grouped in the following table.

TABLE V

Plots	Initial pH	Final pH	Difference	Yield per *are*	
Complete manuring	6.55	6.85	0.30	25 833	Kgs
Without nitrogen	6.50	6.70	0.20	30 833	"
Without P_2O_5	6.60	6.95	0.35	24 166	
Without K_2O	6.70	7.10	0.40	15 833	
Without manure	6.80	7.05	0.25	23 333	

While badly aerated soils have a distinctly acid reaction, sound soils the aeration of which has been completely destroyed for 48 hours under a temperature of 23°C show a perceptible decrease of their acidity or even have become alkaline.

The reaction of the soil is therefore subjected to the action in opposite directions of two forces of micro-organic origin. If one of these two forces happens to be entirely lacking, the action of the other will in the course of time markedly change the reaction of the soil so as to hinder all normal vital development. In sound soils, owing to the antagonistic action of these two forces, the reaction oscillates to left and right like the point of the hand of a self registering barometer.

4. *Relation between the two categories of micro-organisms and the yields.* — Two methods are in use for evaluating a soil from an agricultural point of view :— chemical analysis and physiological analysis.

The former is a rapid method, but by itself only gives very slight indications, while the latter is more efficient, but only gives results after the lapse of much time.

Our investigations enable us to discover a new process which we will call " biological ". The following comparative table brings out our starting point.

TABLE VI.

Plots —	Yields per *are* —	Aerobic bacterial activity (Table II) —	Anaërobic bacterial activity (Table V) —
2. No nitrogen . . .	30.833 Kgs.	0.70	0.20
1 Complete manuring	25.833 »	0.55	0.30
3 No P_2O_5 . .	24.166 »	0.40	0.35
5. No manure . .	23.333 »	0.35	0.25
4. No K_2O	15.833	0.10	0.40

It is seen that in normal conditions the yields are proportional to the richness in the aërobic bacteria of the soil, and inversely proportional to the richness in anaerobic bacteria, and in a more general way :—

The fertility of a soil is directly proportional to its aerobic bacterial activity and inversely proportional to its anaerobic bacterial activity. This is readily admitted if it is realised that a soil must become enriched in anaërobic bacteria according as it loses its physical properties favourable to plants (good aëration due to a lumpy character of soil, for example). The investigation of several categories of soils (clay, sand, sandy-clay, humus, etc.) of different qualities makes it possible to draw up tables which will give directly the degree of fertility of the soil examined.

D. — STAGONOMETRY : — NEW PROCESS FOR DETERMINING pH.

The utility of the extension of hydrionometric research has led us to seek for a less cumbrous method at least as precise as the ordinary colorimetric method which required considerable preparation and apparatus and in which moreover the shades of the scale become paler under the action of light, leading to errors.

When 1 cub. centimetre filtrate is treated with an appropriate

indicator, a change in colouring results of which the degree of transformation measures the H ion concentration.

This degree of transformation is rapidly determined by adding drop by drop an " alkaline reagent " to 1 cubic centimetre of type solution of known pH. The number of drops added to get the same coloration as the soil filtrate, to which an equal quantity of the indicator has been added, measures the (H^+) of the soil solution, concentration being read on the curve which corresponds to the indicator used. The " alkaline reagent " and the known pH are prepared commencing with CLARK and LUBS' stock solutions. The indicators are thus the same, but diluted to 0.01 %, which enables 1 drop of the indicator to be added for 5 drops of " alkaline reagent ", 20 drops of the drop measure used equalling 1 cc. of the alkaline reagent.

The "alkaline reagent " is composed of : —

$$50\ c^3 \text{ of } KCl\ \frac{M}{5}$$

$$50\ c^3 \text{ of } H_3BO_3\ \frac{M}{5}$$

$$43.9\ c^3 \text{ of } NaOH\ \frac{M}{5}.$$

The solution of known pH is the CLARK and LUBS' type solution pH 5.8, no soils treated by us having given a stronger acidity than pH 6.2. The vessels in which the colorimetric (or stagonometric) (1) tests are made, consist of at least two small pure white porcelain basins. The covers of small crucibles upside down are very suitable for the purpose.

Into the first is put one cubic centimetre of very clear soil filtrate and 4 drops of the appropriate indicator. Into the second, in its turn, 1 c.c. of the solution of pH 5.8, 4 drops of the same indicator, and drop by drop " alkaline reagent " until perfect identity of coloration is reached.

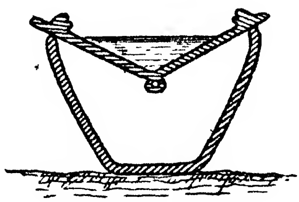

FIG. 41. — Vessel for stagonometric tests

Note that one additional drop of the same indicator per 5 drops of " alkaline reagent " is required to maintain approximately con-

(1) From the Greek stagon = drop.

stant the relation between the quantity of indicator added and the volume of the liquid affected

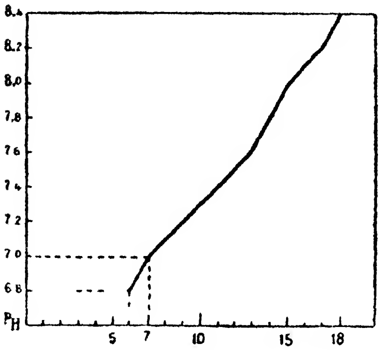

FIG 42
Phenol Red (6 8 to 8 6) Curve

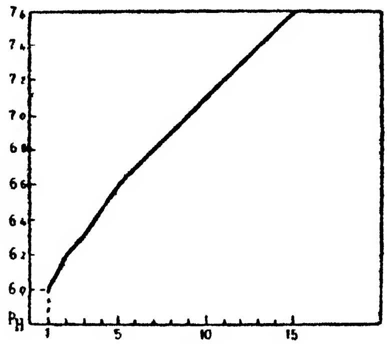

FIG 43
Bromothymol Blue (6 to 7 6) Curve

A curve can be drawn for each indicator The method can be adapted to cover the whole pH scale

ELIE AGHNIDES,
Agric Engineer, Athens, Greece

GRAPHIC REPRESENTATION OF THE KOPECKY SOIL CLASSIFICATION SCHEME FOR TECHNICAL PURPOSES.

Ing. J. SPIRHANZL published in the January number, 1925, of this Review a " graphic aid " to the KOPECKY soil classification scale. The same reasons which caused Ing. SPIRHANZL to reduce the KOPECKY scales to a more synoptical form led me to find the following method (exhibited at the Exhibition of the Fourth International Soil Science Congress at Rome).

The form of the circle was chosen partly on account of easier survey, but also in order to be able at the same time to inscribe a " drain distance curve ".

For it is in the first instance the question of the distance between the drains which the agricultural engineer wishes to have answered.

We have not yet any scientifically based law on the interdependence of drain distance and drain depth. We only know that water drains less easily through heavy soil than through more permeable soil, and it follows from this that in the latter case a greater distance apart is permissible than in the former.

As regards the choice of the distance apart of the drains the expert was dependent on his experience.

It is a great service on the part of KOPECKY to have brought his " experience " in regard to drain-distance into mathematical correlation with the mechanical composition of the soil. The expert is thus enabled to determine the drain-distance on the available basis of the composition of the soil. FAUSER and GANS have calculated the results of KOPECKY for the climatic conditions of Würtemberg. But in these data of FAUSER there were principles derived from experience. By experiment KRÜGER gave to these principles a scientific basis, which confirmed the accuracy of KOPECKY's observations. (KRUGER, Int. Mitt. f. Bodenkunde, Vol. XI, pp. 105-110, Berlin, 1921).

I have now brought the soil classification scheme of KOPECKY to a system of sectors of a circle. The circumference of the circle is divided into 80 parts, for the percentage content of fraction I (diameter less than 0.01 mm). On the radius the proportion of fraction II is drawn to contents of 40 %. The sectors so formed represent the types of soil.

Kopecky's, experience for our climate, according to the composition of the soil, with a drain depth of 1.30 m., distances of 8-24 m. have proved correct.

The direct reading, which corresponds to the distance suitable to the mechanical composition of the soil determined by analysis, can be taken from the graph without compasses or any other aid, direct on the inscribed " drain distance curve ".

It is of course natural that the measurement of the distance, based on the mechanical composition of the soil, may undergo certain alterations due to local circumstances (sloping land, lime and iron contents). But the basis of the determination of the drain distance can here be formed in accordance with mathematical view points, and estimation, with its subjective errors, is avoided. This determination is only valid, of course, on the hypothesis, which indeed can seldom occur, that the soil is of uniform quality to a depth of 1.3 m. throughout.

In general we shall have to deal with different layers of soil. Each of these layers would, however, require a different drain distance. Dr. Blauth, Lemberg (comp. Friedrich, Wasserbau, Vol. I, p. 340) gives a graphic method of determining the correct distance with layers of different permeability. The process corresponds approximately to the penetration of a ray through different media, it being sumed that " ideal water " moves in a similar manner in the ground.

The results obtained, in any case, agree pretty well with experience with regard to the correctly measured dike distance, so that this method can be considered as practicable.

With my curves, with only two different layers, the corresponding distance can be read off, without any measuring or drawing (such as Blauth gives).

For instance, the upper layer is sand (50 cm.) ; the corresponding dike distance for sand would be 20 m. ; the lower layer is clay (80 cm.); the corresponding dike distance 8 m.

The determination now takes place in the following manner : we only require to look for the intersecting point of the curve with a connecting ray which indicates the corresponding thickness of a layer : e. g. 50 cm. sand, or 80 cm. of clay. The perpendicular on the abscissa axis gives direct the corresponding drain distance ; in the above example 12.70 m., therefore 13 m. The same applies with other layers combinations.

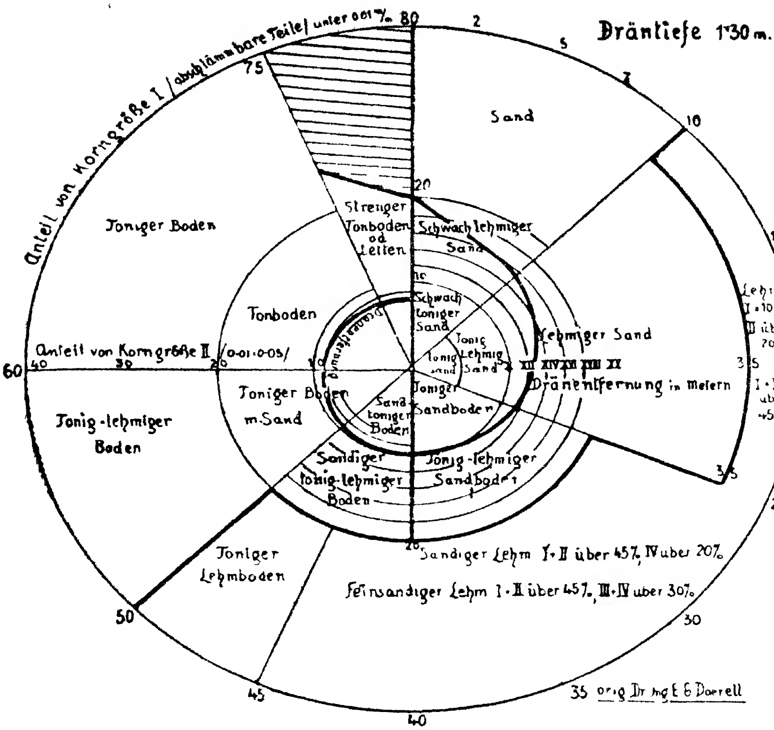

FIG. 14. Representations of the KOPECKY Soil Classification Scheme, with drain distance curves.

Explanation of the diagram

Dräntiefe 1,30 m	Drainage depth 1.30 m.
Anteil von Korngrösse I (Abschlämmbare Teile) unter 0 01 mm	Proportion of particles of Type I (part capable of decantation) of diameter less than 0 01 mm
Sand	Sand
Lehm	Loam
I = 10 — 45	Type I = 10-45
II uber 20 %	Type II over 20 %
I + II uber 45 %	I + II over 45 %
Sandiger Lehm I + II uber 45 % : IV uber 20 %	Sandy loam I + II over 45 % : IV over 20 %
Feinsandiger Lehm I + II uber 45 % III + IV uber 30 %	Fine sandy Loam I + II over 45 % : III + IV over 30 %
Toniger Lehmboden	Clayey Loam soil
Tonig-lehmiger Boden	Clay loamy soil
Anteil von Korngrösse II (0 01-0 05 mm)	Proportion of particles of Type II (diameter of from 0 01-0 05 mm)
Toniger Boden	Clayey Soil.
Strenger Tonboden od Letten	Heavy Clay Soil
Schwachlehmiger Sand	Sand slightly loamy
Lehmiger Sand	Loamy sand
Dränenentfernung in Metern	Drain distance in metres.
Tonig lehmiger Sandboden	Clay loamy sandy soil.
Sandiger tonig-lehmiger Boden	Sandy clay loamy soil.
Toniger Boden mit Sand	Clayey soil with sand.
Tonboden	Clay soil.
Schwachtoniger Sand	Slightly clayey sand.
Tonig lehmiger Sand	Clay-loamy sand.
Toniger Sandboden	Clayey sandy soil.
Sandtoniger Boden	Sandy clay soil.
Dränentfernung	Drain distance.
Toniger Sand	Clayey Sand.

In case we have to deal with several different layers, we first proceed to determine graphically (after BLAUTH) the drain distance of the two lower layers, and then simply apply the ascertained value in the sense of the above explanation, as though we had to deal with a uniformly composed layer.

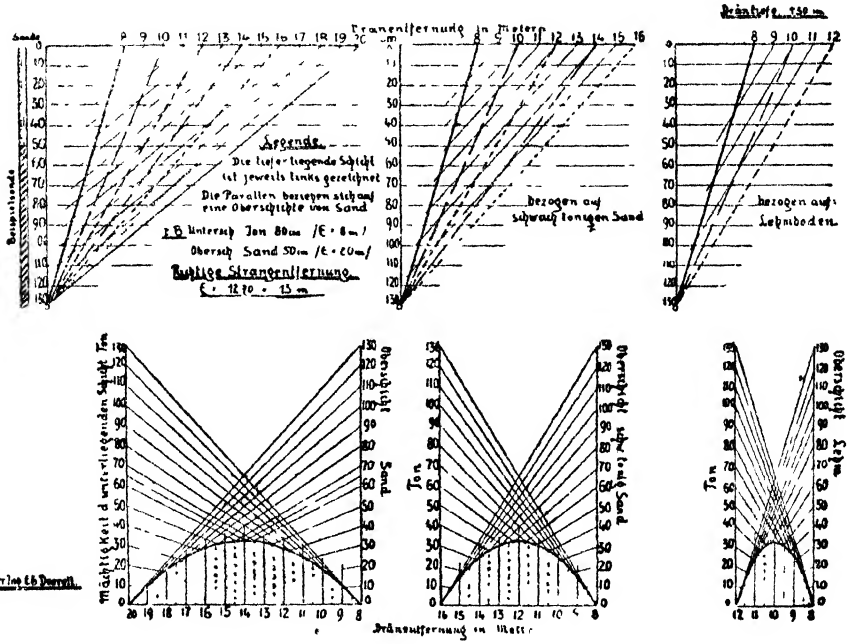

FIG 45 — Diagram (or graphs) for the determination of the drain distance in layers of soil with varying permeability

Explanation of the text

Drantiefe	Drainage depth
Dränentfernung	Drain distance
Sonde	sounding or probing
Beispielsonde	sample probing
Die tiefer liegende Schicht ist jeweils links gezeichnet.	the lower layer is always shown on the left.
Die Parallelen beziehen sich auf eine Oberschichte von Sand	The parallels refer to an upper layer of sand.
Z B Untersch Ton 80 cm (E = 8 m)	e. g Lower layer clay 80 cm drain distance 8 m
Obersch Sand 50 cm (E = 20 m.)	Upper layer sand 50 cm. drain distance 20 m.
Richtige Strangentfernung E = 12 70 - 13 m.	Perpendicular distance E = 12 70 i. e. 13 m.
bezogen auf schwachtonigen Sand	Referring to slightly clayey sand
bezogen auf Lehmboden	Referring to loamy soil.
Mächtigkeit d unterliegenden Schicht Ton	Thickness of clay substratum
Oberschicht Sand Ton	Upper stratum of sand
Oberschicht schwachtoniger Sand	Upper stratum of slightly clayey sand.
Oberschicht Lehm	Upper stratum loam

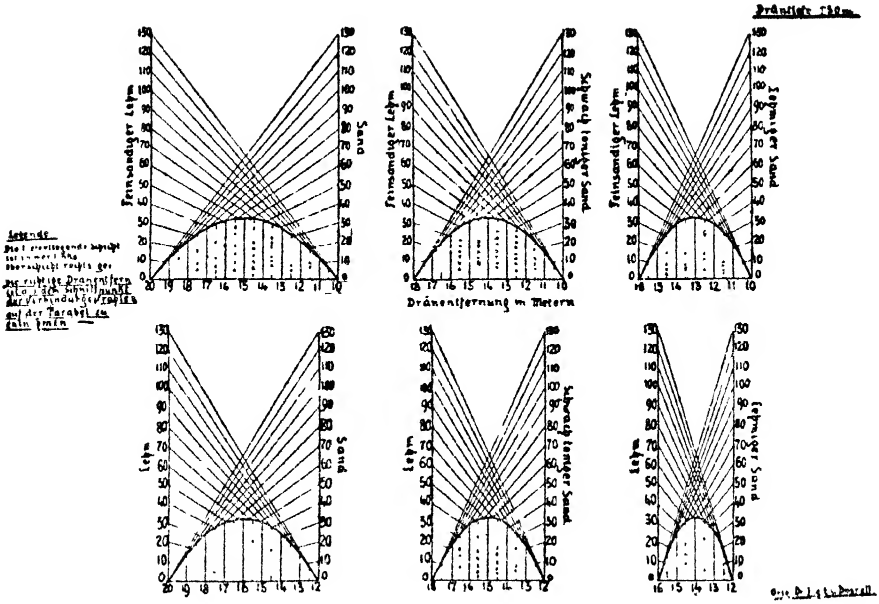

FIG 46 — Diagrams for the determination of the drain distances in layers of soils of varying permeability

Explanation.

Feinsandiger Lehm	Fine sandy loam.
Sand	Sand
Schwachtoniger Sand	Slightly clayey sand.
Lehmiger Sand	Loamy sand.
Lehm	Loam.
Dränentfernung in Metern	Drain distances in metres.
Die tieferliegende Schicht ist immer links, Oberschicht rechts gez	The deeper layer is always shown on the left, the upper stratum to the right.
Die richtige Dränentfernung ist aus dem Schnittpunkt der Verbindungstrahlen auf der Parabel zu entnehmen.	The right distance between the drains is to be inferred from the point of intersection of the connecting rays on the parabola.

Of course, there might still be mentioned the very difficult point whether, in such cases where layers occur which are permeable with difficulty, to a small depth e. g. clay or loam, we could maintain a drain depth of 1.30 m. In general, the tendency to-day, in such cases, is to reduce the drain depth.

E. G. DOERELL,

Prague.

INVESTIGATIONS INTO THE RESISTANCE OF SANDY SOILS TO WETTING.

The water conduction of a soil is influenced in a high degree by the ease of wetting of the soil particles. Even though in general no great differences are to be observed in the susceptibility of the soils to moisture, yet it can often be noticed, especially with loosely laid dusty soils, that after long drainage they only absorb water with difficulty. This fact, however, is in no way confined to dusty soils (amongst these, in this sense, must also be counted powdery peat, "dust mould" and road dust) (1). Even on light-mould sandy soils, as RAMANN (2) has already mentioned, collections of water can occasionally be found in small depressions many hours after rain, whilst the sand lying underneath is still powder dry. Recently BUNGERT (3) has thoroughly observed and described this fact.

As to the reasons for this "resistance to wetting" (4) of the soil, various theories have been advanced. Originally it was assumed that the non-susceptibility to moisture of drained peat or mould particles was caused by a coating of resinous or wax-like matter (5), and RAMANN (6) also traces back the high moisture-resistance to the like substances. "Once drained, these impervious substances coat the soil particles, and offer strong resistance to their saturation". This assumption is controverted on other sides, especially by EHRENBERG (7), in conjunction with PUCHNER (8) and FLEISCHER (9).

These authors assign, as a reason for the difficulty of absorbing moisture by dry soil particles, in particular dried humous material, that these have a great capacity for absorbing air, a less capacity for absorbing water or moisture, and are protected from the moisture by this absorbed air covering (10). As a further factor, these investigators adduce the fact that the air in the capillary spaces of the soil prevents the penetration of water. One of the authors has already shown that in addition to all these factors there are still others, for example the condition of the organic matter to be taken into account in judging the ease for absorbing moisture (11). "Soils with preponderance of acid humus become moist even when only air dried, with disproportionately greater difficulty, and slowness than so called sweet humus soils with an equal percentage of organic matter".

On the occasion of other investigations our attention was drawn

to a soil with extraordinarily poor moisture-absorbing capacity, and its resistance to wetting could not be explained in any of the above ways. It was a fairly coarse diluvial sand with little humus from the Chorin high forest, on which acacias did not thrive. The sand, under a very thin layer of humus after long rainfall, and the thawing away of a fall of snow about 5 cm. deep, contained only 0.63 % of water. Placed in water, its moisture resistance showed itself in the fact that after 24 hours th ewater could be poured off from the unaltered dry soil. A superficial film of water clinging to the sand broke up on being touched. The difficult absorption of water was still more clearly recognisable by the fact that a considerable part of the sand remained floating on the surface of the water, and could be made to sink neither by shaking nor by stirring. These floating portions, however, were in no way composed of the finest fractions of the soil, nor of organic constituent parts. Observation under the microscope showed that grains of quartz predominated, mixed with small grains of felspar or the like, and very small particles of mould. There were also throughout grains of considerable size. A few samples, which had remained floating for about 250 hours, were measured on an oaken ocular micrometer. Out of about 350 grains

61 grains, about	17 %	had a diameter of about	0.02	mm.
35	10 %		0.05-0.08	mm.
117	32 %		0.1	mm.
89	25 %		0.2	mm.
37	10 %		0.3	mm.
14	4 %		0.4	mm.
5	2 %		0.5	mm.
2	0.6 %		0.6	mm.

1 large grain, length about 1.6 mm., width about 0.6 mm.

The measurements must in no way be claimed as being of special exactitude as regards the actual sizes of the grains of sand, or as an exact selection of average samples. They show, however, plainly enough that about 55 % of the floating grains have the considerable size of 0.1 to 0.2 mm., that a large proportion are still larger whilst particles below 0.02 mm. diam. are practically absent.

Similar estimates were applied to a whole series of other samples.

It is obvious that the moisture resistance of grains of this size cannot be due to absorbed air coverings, which in the case of the finest dust no doubt play a part (12), nor to the air retained in the capillary spaces, nor to any coating of resinous or wax-like substances (13). Acid humus, difficult to wet, probably does no enter into the question. The humus content of the sands determined as loss on ignition amounted to 1,17 % and the acidity of the soil was in no way high.

There was found :

Exchange-acidity according to DAIKUHARA : 4.8 ccm n/10 NaOH to 100 gm soil.

Hydrolytic acidity : 21.2 ccm. n/10 NaOH to 100 gm. soil.

We now tried, by increasing the vapour pressure, to make the soil capable of absorbing moisture. For this purpose a sample of air dried soil was kept for 36 hours over water in a vacuum dessicator. At the same time other samples were allowed to stand over different concentrations of sulphuric acid, so that an idea could be formed of the hygroscopicity of the sand. The determination of the water contents of the samples treated in this way gave the following values (14).

Contents of the dessiccator	H_2O	H_2SO_4 %									
		10	20	30	40	50	60	70	80	90	100
H_2O content of the soil in %.	0.98	0.02	0.35	0.26	0.10	0.03	0.01	0	0	0	0

None of the samples showed any difference as regards their capacity for wetting.

On the contrary, moistening at once occurred when a few drops of ammoniac were added to the water.

Treatment of dry soil with gaseous ammonia had a similar result. Ammonia gas, obtained by heating a strong solution, was cooled in a spherical cooler directed downwards, the water condensed in a receiver previously dried being collected. The gas was further dried in a large drying tower having layers of carbonate of lime, and then conducted at a measured rate (about 3-4- bubbles per second) over the soil spread out in a wide glass pipe. After being conducted

over for half an hour the superfluous ammonia was removed by drawing through air for 20 minutes. After that the soil was at once susceptible to wetting. It did not lose this property after it had been exposed to the air for 24 hours in a thin layer.

The objection might be raised that it was originally the absorbed air films which protected the grains of sand from moisture, and that the action of the ammoniac caused the air films, as a result of a greater absorption power of the grains of sand for ammonia to be driven out and replaced by ammonia. The moistening would then be attributed to the very great solubility of the ammonia gas in water. This objection will, however, fall to the ground, as the soil also, became moistened in water containing a little Na_2CO_3. We tried however whether the moistening of the soil might not be attained by the action of other gases but the gases used by us, carbon dioxide and sulphur dioxide, in no way altered the moisture resistance of the soil, in spite of the great solubility, especially of the sulphur dioxide, in water.

We now followed the moistening process of the soil in water and in dilute ammonia under the microscope. Even though an exact picture could not be obtained, as with the necessarily considerable enlargement only a very small part of the surface of a grain could be closely observed, yet we received an impression as though the grains of sand were covered over by a thin, brownish skin, which quickly dissolve in dilute ammonia, and after that allowed the moistening of the grains concerned. It could consequently be deduced with reason that these skins were formed of humus substances. If this supposition was correct, then it should be possible to make the sand take up moisture by removing the humus coating. It seemed to us that heating (although the sand was thereby made saturable) and similar processes were too drastic, and we chose therefore the method, first proposed by ROBINSON (15) and recently recommended by HISSINK (16) for another purpose, for the destruction of the humus substances by means of hydrogen peroxide. It was shown that the soil became moistened after standing for several hours in 3 % H_2O_2, and in 30% H_2O_2 became moistened almost immediately. When the soil, after treatment with H_2O_2, was filtered, washed with water and dried, or stirred directly with H_2O_2 in the water bath and dried by evaporation it still remained easily saturable, whilst a sample treated with water only in like manner maintained its high resistance to wetting.

Another means of removing the humus coating is an acid solution of oxalate of ammonia, as used by O. TRAMM (17) for the removal of inorganic gel coverings of soil grains and also recommended by K. LUNDBLAD (18). As the investigations of TAMM (17) showed that the TAMM solution (31.52 gm. oxalic acid and 62.1 gm. neutral oxalate of ammonia to the litre of water) does not attack the mineral grains of the soil, it appeared to be specially suitable for this purpose. In fact the sand became moistened in a short time in the TAMM solution.

Another proof may be given that the above mentioned operation of the ammonia gas does not depend on the absorption of this gas by the grains of soil. A weighed sample of the sand dried at 105°, treated with ammonia in the manner mentioned and afterwards with air, was boiled with water, and the escaping ammonia was conducted into n/10 sulphuric acid. By titration with n/10, alkali the quantity of sulphuric acid neutralised by the ammoniac was fixed. It was shown that 100 gm. soil had absorbed 0.0204 gm. NH_3, whilst the soil after the destruction of the humus with peroxide of hydrogen, and after washing with water, only retained 0.004 gm. NH_3 (calculated on 100 gm. soil and determined in like manner). It is shown quite clearly, therefore, that the absorption of ammonia only takes place with the co-operation with the humus substances in notable extent, and that the sand free from humus is not favourable to this adsorption.

The question now remains how the influence of the *humus coating on the moisture capacity* of the soil is to be explained. The interpretation that the humus substance covering the sand grains has become irreversible by great drying, and thereby resists the moistening, appears to us not very probable, because if so, these light humus sands, difficult of saturation, would, in our opinion, be found much more frequently. The occasion for the formation of humus coverings, and the drying of these, must arise very often, whilst the high degree of moisture resistance here described is not so often observed. It is possible that the humus molecules, as (according to LANGMUIR (19) the large molecules on border surfaces often do) range themselves in regular formation on the surface of the sand grains in such a way that " lyophobe " groups of molecules are directed outwards. The relative infrequency of the difficult saturability might then, therefore, give the impression, either that not all kinds of humus contain lyophobe groups, or that the humification does not al-

ways result in the formation of lyophobe groups, or that the relationship of humus molecules only occasionally, or only under still unknown conditions, takes place in such a way that the lyophobe groups are turned outwards. It is up to now equally uncertain why the removal of the moisture-resistance is effected by ammonia. It might be that, as mentioned above as being improbable for sand grains, the ammonia is physically absorbed on the humus covering. These ammonia films would immediately dissolve in water, and cause the wetting of the soil particles. Consequently the humus films could then be detached and dissolved by the resulting local concentrated ammonia solutions. In fact, soil treated with NH_3, when covered with water, after some time acquires a brownish colour. That not physical adsorption alone comes into the question is proved by the fact that on boiling soil treated with NH_3 in water, only about half of the ammonia rendered removable by distillation with oxide of magnesia is recovered. There may therefore occur, at least as regards physical adsorption, a chemical reaction between ammonia and mould. If highly humus soils and pure sphagnum peat, all dried at 105° to a constant weight react with ammonia gas under great heat, as we could establish, then theoretically both processes, chemical reaction and physical adsorption may occur even though in our estimation the chemical reaction is more probable.

Unfortunately we must postpone our experiments with reference to the above matter until summer, on account of other pressing work, and above all, for lack of suitable material. Nevertheless it seems to us that our investigations up to now, which in every respect are only considered as preliminary experiments, show plainly that the vegetable humus coverings of the grains of soil play, at least in many cases, a decisive part in the saturability of the soil concerned. And this result appeared to us sufficiently interesting to warrant a preliminary communication.

The treatment of the soil with ammoniac in the form of gas also appears to us interesting in another direction. In this connection we have investigations in train as to whether the adsorption capacity of a soil for NH_3 can be applied to determine its humus contents, and whether eventually conclusions can be drawn from this on the nature or condition of the humus. We will report in due course on the results of these investigations.

R. ALBERT and M. KÖHN,
Soil Science Institute of the Eberswalde Forestry High School.

ANNOTATIONS AND BIBLIOGRAPHY.

(1) Compare, as to this, e. g. B. EHRENBERG: Die Bodenkolloide, 2. Ed. 1918, pp. 246, seq.

(2) RAMANN, Bodenkunde, 2. Ed. (1911), p. 345.

(3) DISS. Forstl. Hochschule Eberswalde 1925; Z. f. Forst- und Jagdwesen, Fasc. 11, p. 547 seq. (1925).

(4) RAMANN, *l. c.*, S. 344.

(5) Literature data EHRENBERG, *l. c.*, p. 248 et seq.

(6) *l. c.*, p. 345.

(7) *l. c.*, p. 259 et seq.

(8) H. PUCHNER, Forsch Geb Agrikulturphysik 19, 11 (1896).

(9) M. FLEISCHER, in VOGLER, Kulturtechnik, 2. Ed. (1898), Vol. 1, p. 119.

(10) Experimental proofs and literature see EHRENBERG, *l. c.*, p. 250 et seq.

(11) Albert, *Journal für Landwirtschaft*, 56, p. 370, 1908.

(12) See the experimental proofs in EHRENBERG, *l. c.*, p. 250 et seq.

(13) To determine whether absorbed air might not be the reason for this appearance, we made the following experiment: A sample of the sand, floating on water in a small dish placed in a desiccator, was exposed for several hours to a vacuum of about 12 mm. No moistening took place after 36 hours.

(14) All the analysis data are average values, each of two denominations.

(15) Jnl. of Agric. Science, XII, p. 287 et seq. (1922).

(16) Mitt. d. Intern. Bodenkundl. Ges., New Series, Vol. I, No. 3, p. 158 (1925).

(17) *Meddelanden fran statens skegsförs öksanstalt*, Fasc. 9, No. 4 (1922). Communications of the Swedish State Experimental Station for Forestry.

(18) *Ibid.*, Fasc. 21, 1924.

(19) Journ. Amer. Chem. Soc. 39, 1894-1906-1907) comp. ZSIGMONDY, Kolloidchemie, 5. Ed., pp. 109-114. Leipzig (1925).

ON THE LIMITS OF BIOLOGICAL INQUIRY IN SOIL SCIENCE.

" *Some unknown cause* " — it would seem — led GEORGES VILLE to the much challenged results of his celebrated experiments establishing the remarkable gain of nitrogen which takes place during the cultivation of leguminous plants.

The ancient world which lived — and unavoidably so — in ignorance o. micro-organisms was nevertheless aware by intuition that something must intervene before the indirect elements of nutrition could enter into the structure of the plant organism; and while labouring under the disadvantage of the virtual impossibility, with the means then available, of following the metamorphosis of alimentary materials in agricultural soil, it arrived at the assertion of the existence of transformations such as had effects of manifestly fundamental importance.

The important subject of the fertilisation of the soil was really involved in the question.

This subject deeply engaged the minds of students; all kinds of paradoxical theories were indulged in by scientists; feeling ran high between manufacturers and dealers of manures.

Theories of all kinds found acceptance, deriving life from organic matter, from a vital principle, from humus, from nitrogen, from minerals.

While this *unknown cause* was for the " vitalists " who were the most advanced section of the " humists " a transcendental one, if for them it was not necessary to go much further than the *vital matter* of TREVIRANUS, for the true " humists " everything consisted, at most, in some physical and chemical actions, play of movements and attractions of masses or of elemental affinity.

Even the ideas diffused with great energy by LIEBIG and defended by him against those who maintained theories on organic substances and nitrogen were not free from errors, some of a serious and fundamental nature. The relinquishment of experimental work in favour of polemics conducted with liveliness, not to say acrimony, led LIEBIG to form that erroneous inference, which consisted in attributing to the organic substance of the soil and manures value only such and so far as mineral bodies resulted as the final product

of its destruction. Reasons of space do not allow of the quoting of certain very striking passages in the works of LIEBIG.

Between the premise that a successive series of crops impoverishes the soil and the conclusion that for a return *to the fixed point* nothing is necessary but the restitution to the soil of the elements of the plant ashes previously removed, we shall find that LIEBIG interposes this scientific contribution :– Ammonia and the combustible substances of manures have a stimulating effect ; fallowing and tillage are of value for cleaning the soil of weeds or for mechanical modifications of the soil ; organic substances have no power of producing abundant crops; the action of stable manure depends solely on the mineral elements contained in it. For that reason it must be useless, or even harmful, for fodder to pass through the digestive system of animals ; stable manure was not indispensable to plant production ; and, in short, everything would be reducible for plants to the preparation and administration of tabloids, just as has been prophesied for the nutrition of Man, who is to be, in the future, a non-material being. To form an idea of the phenomena of capital importance which develop in the soil and which these theories completely ignore, it suffices to go back to that biochemical cycle of phosphoric anhydride which is made evident by our researches and in which is involved the active power of almost all mineral salts useful to the plant (Fig. 15).

The action of phosphorus in the soil is accomplished in two opposite senses, namely it passes from monometallic phosphate, through bimetallic, trimetallic phosphate and viceversa. In the first case the action is physical and chemical, in the second case biochemical, both, one and the other, in a fixed correlation.

Along with the interplay of the acids and acid salts of phosphorus with the various bases of the soil, the micro-organisms cause an evolution in the organic substance of the soil, from which originate more or less complex *phosphorganic substances*, acid or containing acid radicals which easily become free, and they too contribute largely to the mobility of the potash, lime, magnesia, iron, etc.

Hence there are two cycles of the phosphorus in the soil :— the *mineral* and the *organic*. The extreme limits of the first are basic phosphate and acid phosphate. This once formed, and a certain proportion of bases attacked, unless some factor maintaining the biochemical conditions of its existence intervenes with the

occurrence of chemical and physical actions, it returns to the insoluble state.

In the organic cycle, on the other hand, this *retro-gradation* does not take place ; and the phosphorated substance, more or less salified, soluble or easily soluble by saponification of the large nuclei from

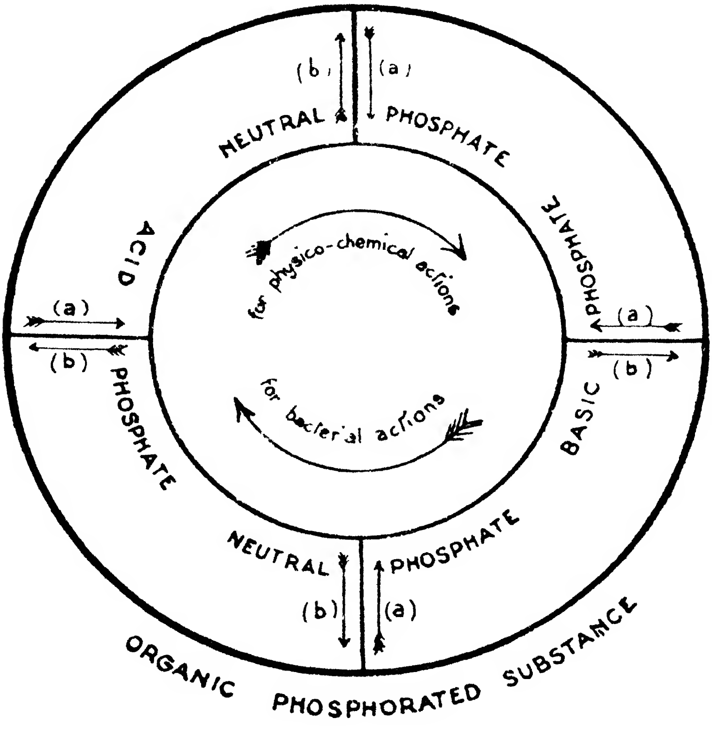

FIG. 47 — Cycle of phosphoric anhydride in the soil.

which it results, is to a great extent employed directly in the metabolism of new forms of life which succeed one another unceasingly in the soil.

Moreover, continuous relations of transformations exist both in one sense and the other between the two cycles by which one form of phosphorus can pass more or less indirectly into the other. And, on the one hand, forms of autotrophic life, and on the other those of heterotrophic life intervene. By the one, mineral phos-

phorus may at any moment pass from its circle into the organic; by the other, on the contrary, it may return to the mineral state. But since the organic combinations of phosphorus constitute a material productive of energy, they tend to effect biochemical transformations in the way of mineralisation which is agriculturally disadvantageous; however the opportune provision of dynamogenetic materials interferes with the play of bio-reactions and leads to useful results.

We are inclined to dispute the right of anyone to suppress, with or without LIEBIG, in the name of science and of the so-called results of practice, the fundamental function of organic matter in the economy of the medium in which plants live. Nor can we admit that any one should endeavour to specify the contribution of science to agriculture by a simple mathematical relation such as:

$$\begin{array}{ccccc} P & = & A & - & O \\ \text{production} & = & \text{available food} & - & \text{opposing factors} \end{array}$$

A biological phenomenon, one may say a complex series of biological phenomena relating to production, is not represented by any mathematical formula, either simple or complex. Besides it presupposes that *the environment in which plants live is something fixed, unchanging and that the vegetable kingdom is directly dependent on the mineral kingdom.*

The real truth is that agricultural soil is not an unchanging entity and that between minerals and cultivated plants there is interposed such a complex series of phenomena and factors dependent on the new realm of micro-organisms as to make Liebig's equation appear an irony.

Organic matter, considered as the stimulating force of the life which teems in vegetable soil and of its perpetual mutability, is evidently not the matter of TREVIRANUS and of other "humists" and still less is it that accessory or superfluous element which LIEBIG conceived it to be.

To organic matter we attribute in agricultural economy a preponderant and absorbing function in the unfolding of that micro-organic activity which cannot be wholly suppressed and in the well ordered and useful action of the material substratum, where these exchanges of matter and energy take place whence the higher plant draws the very possibility of its existence — namely the soil.

Our conclusion then is that the manifold forms of life may be

united under a single general conception of correlativity which corresponds to the rea *functional correlation* (*symbiosis*), as it exists and, is every day more fully proved to exist, in Nature.

* * *

The tendency for two or more elementary organisms to unite to form higher grades of individuality is clearly manifest in ontogenesis as in phylogenesis · between these organisms there exist relations of descendance. But where such relations are non-existent, there arises this new fact which originally formed the subject of morphological investigation by DE BARY and which is called *symbiosis*.

A new chapter of the biological sciences was thus begun, to which as time went on a development brilliant beyond expectation was assured by the progress of research : that, in general, of the relation between organisms which, governed by the need of food, lead to reciprocal exchanges of substance and therefore to more or less intimate relations, pacific or hostile.

The type of nutrition known as *saprophytic* will be dealt with here under *symbiotic nutrition*, which is interesting in itself apart from its characteristics, as it is a phenomenon of extraordinary importance in natural economy and, particularly, in the investigation of the soil.

A primary distinction which has been made as regards life in common is that of *mutualistic* life and *antagonistic* life, according as the exchange of matter takes place with reciprocal advantage, with one-sided advantage (commensalism), or with injury of one of the organisms.

Antagonistic symbiosis, which is *parasitism*, is here considered as throwing light upon the other form of symbiosis which is the true form and constitutes in nature the evolutionary fact while in soil science and agriculture it is a subject of study and a means of technical improvement.

Between antagonism and mutualism there is no precise boundary, and through all the transition states from the facultative to the obligatory, from variability to fixity, from one-sidedness that is of no consequence to that which is injurious, absolute reciprocity is ultimately attained, without excluding the phenomenon, perhaps more astonishing, of alternation between one and the other kinds of life.

It used to be thought that pathogenic power, within quantitative limits — varying between virulence on the one hand, and recep-

tivity on the other — was a characteristic property of certain species, but this theory is not now generally held, while the view is gaining ground that certain species, essentially saprophytic, are forms capable of developing a pathogenic power.

Indeed, the power of adaptation among microbes is very great and if this is easily established in the case of the antiseptics, it is presumed that it can be verified also against the antibacterial actions of the humours and cells of the host organism. With the alternation of the conditions of occurrence of activity of one or other organism may come alternation of the two regimes of life with opposite characters; and hence the mechanism of nutrition becomes extraordinarily instructive.

The contrasting play of actions and reactions between the two organisms only begins when the saprophyte becomes an *epiphyte*.

The phenomenon is also more interesting when the number of the individual epiphytes increases and they become *endophytes*.

Thus one passes to still more advanced stages of infection and to still closer relations of commensalistic and mutualistic symbiosis.

It is a very instructive fact that the attack of *Rhizoctonia* is essential for the germination of the greater number of the orchids, the influence even persisting on the later development causing more or less profound manifestations and morphological changes; but the examples of relations between vegetable organisms of different nature, phanerogams and cryptogams, especially fungi, are varied and numerous, a striking example being that of the *mycorhizae*. The phenomenon of the mycorhizae constitutes in fact one of the many cases of struggle between a given organism and a parasite which invades its tissues. Phagocytes on the one hand and anti-bodies on the other, it may be supposed that they would enter into play in the mechanism of nutrition of a large number of plants which, while they hold the invader in check, avail themselves either of the material constituting its body or of its functional character. And this under conditions of an unstable equilibrium, which, while normal and indefectible, is still the resultant of many conflicting forces, such as may on the one hand work or improvement but on the other have the power to bring about vital destruction.

* * *

But the physiological research on entomophytic fungi, begun about 1900, would lead, as regards the association of bacteria with

the higher plants, to an order of ideas diametrically opposite to that held in relation to the micro-organisms when they invade the organs of a plant.

The notion of *pathogenic agent* has been contrasted with the clear demonstration of the distinct tendency which organisms have to utilise the useful physiological work of symbiotic micro-organisms. This fact is demonstrated by the forms of *Isaria* and *Botrytis* in the larvae of wood-eating insects (PORTIER), by bacteria localised in the blind diverticoli of the middle intestine of the larva of the olive fly (PETRI), by the photogenic bacteria contained in special organs of many luminous deep-sea fish or other forms of life (PIERANTONI), etc.

The conception of *physiological micro-organism* is thus formed and enters also into the study of symbiosis in plants, marking the beginning of a series of very interesting enquiries.

The bond between bacteria and leguminous plants was carefully studied, but outside this case which was considered rather unique than rare, any schizomycete which might attack a higher plant was judged to be some kind of infective micro-organism or other. The researches of VON FABER on *Mycobacterium rubiacearum* in the genus *Pavetta*, of MIEHE on the bacteria *foliicola* and *repens* in *Ardisia crispa*, of GEORGEWITSCH on the leaf nodes of *Kraussia floribunda*, of CAUDA on *Bac. cruciferae* and finally the author's own researches on the root bacteria of *Diplotaxis erucoides* and of *Calendula officinalis*, all mark a highly important change in the direction of the enquiry into bacterial symbiosis in plants.

Investigators of the biological significance of the union of a bacterium with a plant limited themselves to determining if such union constituted, or not, the medium for the utilisation of the elemental atmospheric nitrogen. Does the bacterium fix the nitrogen or not ?; and the discussion ended there. This question is not, however, a main consideration, as we have maintained and now maintain that, in symbiosis, not merely a single function, such as that of assimilating nitrogen, but many functions may be performed by one of the partners. In the cases investigated it was possible to prove that there was secretion by the bacterium of proteolytic and amylolytic diastases, by which the circulation of nitrogenous substances and carbo-hydrates in the body of the plant may be greatly influenced.

It is, accordingly, undoubtedly desirable to take wider views in

regard to bacterial symbiosis in the higher plants and this conviction has been confirmed by further researches, whereby it was possible to ascertain the presence of bacteria in the roots of a great number of phanerogams

Bacteria have been found in Caryophyllaceae, Chenopodiaceae, Compositae, Cruciferae, Euphorbiaceae, Gramineae, Labiatae, Malvaceae, Papaveraceae, Poligonaceae and Solanaceae, diffused in the thickness of the cortex, in some cases in the outermost zone of the bast, in the intercellular spaces and even in the interior of the cells; this occurring in 75 % of the species examined and in such numbers as to exclude all possibility of accidental presence

The presence of these bacteria may have been non-essential but in view of the physiological conditions of the subjects examined it was doubtless advantageous; and in this sense we have described the fact as *normal*.

To this form of union between green plants and bacteria, newly discovered, we have given the name "*batteriorriza*" (' bacteriorhiza ")

The infection -- if it is permissible to call it so — is limited to a well defined zone of the root, namely the cortex and the outermost part of the bast, indicated as the *symbiotic region* or the zone of occurrence of these inter-relations of the common life of the different organisms · beyond that zone no more bacteria are traceable, and in the so-called *metasymbiotic* region is begun the biophysical and biochemical evolution of the useful and useless products of their cumulative metabolism

That the forms giving rise to this " bacteriorhiza " should constitute a single fixed species, whether for a given family or a given group of plants, is inadmissible. It is probably a question of *physiological types*.

Some stocks, behaving functionally in a similar if not identical way, differ by the intensity of the attack it is a case, so to speak, of micro-organisms of the same functional type, though it is not very easy to say whether the similarity is an original or an acquired characteristic.

In the case of other stocks which show more marked differences of functional activity it is doubtful whether they should be attributed to different species, which, happening to find themselves in identical conditions of life, have come to show the same activity in a greater or less degree.

In the first case we have phenomena of adaptation *in divergence*,

in the other *in convergence* and, this, with varying degrees of divergence from a common stock of origin or of approach in similarity made by a number of originally differing types: in either case that equilibrium which is the condition of bacteriorhiza results from it.

The accompanying diagram will make this clear (Fig. 48).

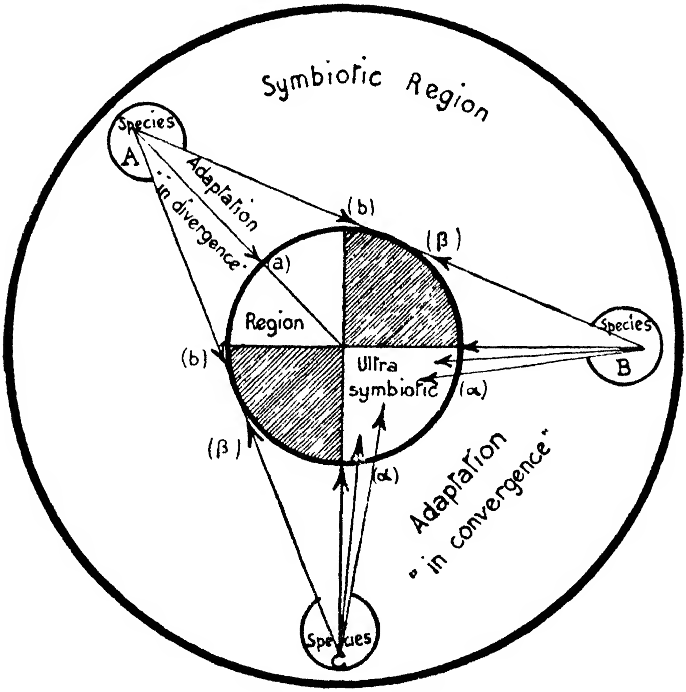

FIG. 48. — Diagram of the adaptation of forms in " bacteriorhiza ".

The individuals of species *A*, in unfavourable struggle with the physiological activities of the plant, adapt themselves to a limited extent and in small numbers to the conditions of life of the symbiotic region into which they have penetrated; and while one part, indicated by the arrow *a*, enters into symbiosis, the greater part avoids adaptation exhibiting abnormal characters, as indicated by the arrows *b* forming tangents to the ultra-symbiotic region.

The individuals of the different species *B* and *C*, undergo this adaptation more easily, and even if to a certain extent they follow the part marked by the tangential arrow *B*, for the most part

they come out victorious in the struggle with the plant which is their host, as indicated by the numerous arrows, drawn into the orbit of its functional activity, assuming morphological and physiological characters to a great extent similar and determining the bacteriorhizical equilibrium.

The sectors cross-hatched indicate the reunion and superposition of influences of the symbiotic individuals of all the species *A*, *B*, *C*... which re-inforce each other's value.

* * *

In typical mutualistic symbiosis alimentary exchanges take place directly between the organisms thus united ; but very similar relations may exist without any morphological bond, so that a greater or less reciprocal dependence may arise between two or more separate organisms. Hence the distinction between *conjunctive* and *disjunctive* symbiosis.

Disjunctive symbiosis has not yet been duly considered, except from a general and speculative stand point for some limited cases. It deserves, however, a much fuller investigation, since it does not fall within the scope of this article to consider the cultivated plant in itself, as did the " humists " and the " mineralists ", but in intimate connection with all the biological environmental factors influencing its growth, and in particular micro-organisms. Disjunctive symbiosis conduces to the formation of food material ; it induces changes in nutritive soil and in the surrounding medium ; it determines specific actions of certain products and of certain secretions. Thus unassimilable substances become assimilable ; and while toxic secretions or elaborations of certain substances determine the occupation of the soil as between competing forms, other products render possible catalytic or chemiotactic influences or exercise a stimulating effect on exchanges of matter in very many lower and higher forms of plants. Numerous observations have abundantly shown that in the environment surrounding the root are evident, more or less intensively, attractive and selective influences of micro-organisms, the micro-flora thus appearing more numerous and more active. This peculiar environment we indicate as " *rhizosphere* " On the other hand it is evident that throughout the whole depth of cultivable soil, not directly in contact with the root, in relation to the proportion and composition of humic matter certain

remarkable and continuous relations of functional correlations are established in the micro-flora, such relations contributing more or less remotely to the metabolism of the higher plant.

There arise in such a way, between micro-organisms *combined effects* of great importance; effects simultaneous or successive, distinct or combined; with final results depending more often on multiple and variable conditions, always self-regulated. And, as in any specified organism, functioning occurs as the result of interaction of elements differing in form and function, so in the *great polymorph colony*, as which it is desirable to consider "*edaphon*", the great organic laws of the division of physiological labour and of correlativity are undoubtedly at work. The conception of agricultural soil, as a *living unity* which has been ours for a long time, has found confirmation in successive researches and still appears fully justified.

* * *

But the combined influences do not and could not stop at the dividing limit between the external medium and the internal medium of the plant, *i. e.* at the cell wall of the root hairs. They find their complement in the diosmotic exchanges which take place through the cell wall; so that with the continuity of the anatomical elements of the root and of the rhizosphere, corresponds a functional continuity which starting *from the disjunctive microbe, may be considered as developing up to the elementary green organ.*

We have been able to show how the green plant modifies variously and considerably the environment of the micro-organisms in humus, bringing about in them a selection, which is reflected directly in the principal microbic functions of the soil and, consequently, in the functioning power of the plant itself.

Plant and micro-organisms therefore tend alike towards that functional equilibrium which, while subordinate to necessary and sufficient condition of the nutritive phenomena, even *without conjunction*, seems characteristically a form of symbiosis — the first step, that is, of specific relations between superior and inferior organisms in the soil.

Such relations may exist for each group of allied plants, in a defined area of soil which we have called the "edaphosphere".

* * *

As the final, elementary limit of phenomena of correlativity and therefore of the scale of all the symbiotic relations is to be considered the *chloroplast* and it is with its functioning, directly bound up with the *edaphosphere*, that the circle of the general evolution of matter in Nature is closed

If we indicate by the term "histophere", the internal environment of the plant where conjunctive symbiosis can take place, we obtain the accompanying diagram (Fig. 49)

The "edaphosphere", that is to say the nutritive sphere of the soil, which teems with micro-organic life at the expense of the humic and mineral substances contained in it, — the seat for that reason of incessant biochemical changes, by which matter is made soluble and *induced* – –, is tributary to the "rhizosphere" that is to say to the sphere of soil adjacent to the roots of a plant with chlorophyll, where the micro-organic development, influenced by the osmotic exchanges depending on root absorption, is increased and made *selective*.

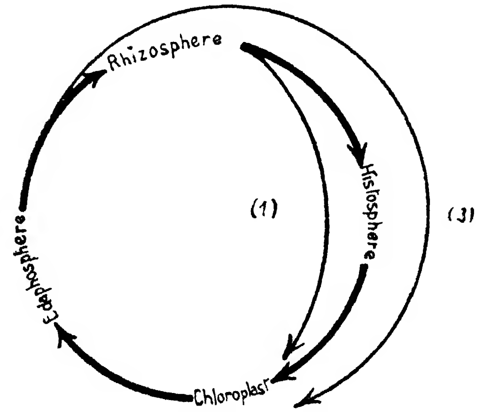

FIG 49 – Simplified diagram of the relations between the micro-organisms and the given plant.

The "rhizosphere" in its turn is tributary to the "histosphere" that is to say to that area of the root tissues in which bacterial forms and fungoid forms assume close and direct relations of morphological and functional correlativity, so that such forms may be considered as having come to be part, in a special state of *equilibrium*, of one single organic entity, individualised in the harmonic complex of the absorbent, conducting, assimilating, and reserve systems of the plant.

Direct relations of the edaphosphere and of the rhizosphere with the chloroplast itself are not however to be excluded (indicated in

the diagram by tracings 1 and 3), since they depend on two facts of capital importance :— *that the edaphosphere and the rhizosphere constitute the source, perhaps the most important source, of carbon dioxide for the plant and the histosphere is part of the organs of synthesis of the complex substances.*

There are *terrestrial plants* and *aërial plants* – aërial, in the sense that they have a crown of foliage and spread their branches on high, utilising the smallest quantities of carbon dioxide ; while the others, accustomed to higher tensions of this gas, remain low, creeping and with thick leaves and utilise directly the carbonic dioxide which is formed in the soil. The gas in fact circulates from the atmosphere to the soil and from the soil to the atmosphere, meeting, in both passages, defined organs of synthesis and of transformation which are in the histosphere.

It follows that it is indispensable to consider the necessity of encouraging such gaseous exchange which, in conjunction with the complex of the very important phenomena above described, neither humists nor mineralists took into consideration ; sometimes they had no suspicion of it, and at other times denied it in more or less good faith !

* * *

We may summarise, thus, in the accompanying diagram (Fig. 18).

The diagram shows primarily the edaphosphere, the general sphere of elaboration of the foods for the plant.

It includes immediately the rhizosphere, the particular sphere of elaboration of the actual foods, in which the processes become more active and selective.

We pass next into the internal environment of the plant distinguished in the histosphere and in the ultra-symbiotic region. The attack of the symbiotic bacterium is limited to the histosphere where it succeeds in finding its conditions of *equilibrium*. In it are realised three different degrees of conjunctive symbiosis : —

(1) *bacteriorhiza* (PEROTTI) ;
(2) *mycorrhiza* (FRANK) ;
(3) *Organorhiza* (tubercles, mycodomazi, bacteriodomazi).

In the meta-symbiotic zone the tissues of the plant are immune from the attack of any micro-organic form whatever and in them

are elaborated the products of the separate activities, as conjunctive activities of the symbiotic organisms with the centre of gravity of the phenomena. the assimulating organ — the chloroplast.

Taking all these facts into consideration, the limits of the biological enquiry in soil science are easily perceived.

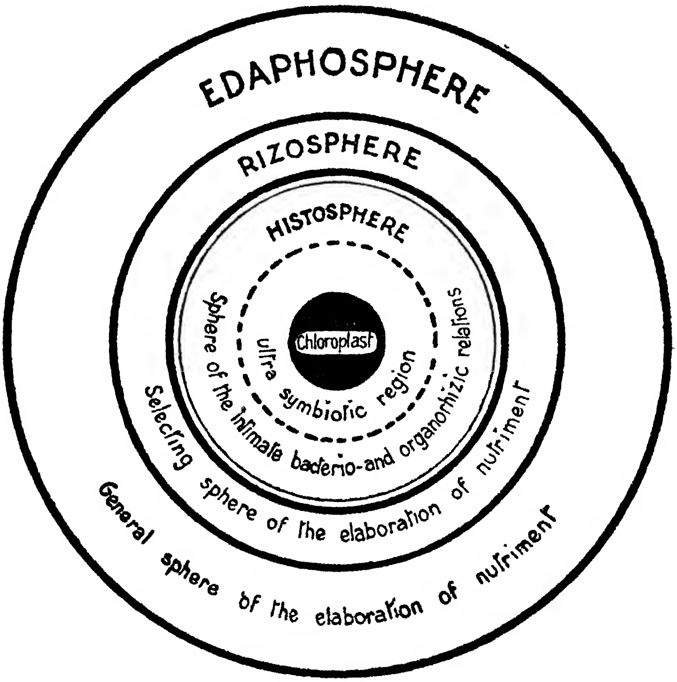

FIG. 50. — General diagram of the symbiotic relations in Nature with reference to the nutrition of plants.

The organic world cannot be conceived as resulting from distinct, and perhaps not even from fixed units. Every phenomenon is the consequence of another vital phenomenon which has preceded it: thus a *form* finds its reason for existence in another form — apart from the question of *origins* which does not concern us here. The cultivable soil is thus considered as a living unity, with its skeleton, more or less broken down, and its morphological elements, more or less differentiated — the whole in the most harmonic complex that can be imagined.

No absolute and crude separation should be made, as is done

in the technical operations depending on our theoretical speculations, between one element and another which in Nature exist in a fruitful correlation, nor is such separation intended here.

Therefore the biological study of the soil should pass on beyond the limits of the edaphosphere to the more intimate limits of the histosphere; from the microbe scarcely influenced by the surplus products of the life of a determined species, to the microbe which has found its way into the convolutions of the structural joints of the green plant until that condition of equilibrium is reached which binds them more or less indissolubly together.

And thus the chloroplast is reached, the ultimate expression of the activities of synthesis which in conjunction with the opposing activities of analysis constitute the tangible aspect of that eternal interplay which is life, the succession of all lives. It was thus justly resolved to include in the general theory of *soil science*, the section of plant physiology. Human thought moves by induction and by deduction; science progresses with analysis and with synthesis. Every time that in the history of physiology, as of science, one or the other of the methods is observed to prevail, the results prove fallacious. Progress is only there, where deduction is blended with induction and analysis harmonises with synthesis. Let us conform our enquiry to this criterium at the same time rendering homage to the supreme law of the indestructible harmony of Cosmos.

R. PEROTTI,
of the Royal Laboratory of Agricultural Bacteriology and of the Royal University of Rome.

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PEROTTI R. — Sulla presenza di una specie batterica nelle radici della " Diplotaxis erucoides " D. C. *Rend. Acc. Lincei*, Vol. XXVIII, Ser. 5, 1. halfyear, No. 9, p. 331.

PEROTTI R. — Ulteriori ricerche sui bacilli radicali della " Diplotaxis erucoides " D. C. *Rend. Acc. Lincei*, Vol. XXIX, Ser. 5, 2. halfyear, No. 11, p. 361.

PEROTTI R. — Ancora sui bacilli radicali della "Diplotaxis erucoides" D. C. *Rend. Acc. Lincei*, Vol II, Ser. 6, 2. halfyear, Nos. 1 and 2, p. 46.

PEROTTI R and CORTINI-COMANDUCCI J. — Normale presenza di batteri nelle radici di numerose fanerogame. *Rend. Acc. Lincei*, Vol. XXXI, Ser. 5, 2. halfyear, No 10, p 484

PEROTTI R. — La "batterioriza" *Rivista di Biologia*, Vol V, No 4.

PEROTTI R and ZAFFUTO G — Sui bacilli radicali della "Calendula officinalis" L. *Rend. Acc. Lincei*, Vol XXXII, Ser 5, 1. halfyear, No. 2, p 94.

PEROTTI R. — La teoria microorganica della concimazione Publisher: Sapientia Rome, 1925

THE CARRASCO-PLANCHER APPARATUS IN SOIL ANALYSIS.

The CARRASCO-PLANCHER (1) apparatus for the elementary analysis of organic substances has proved of great service in this Laboratory of Agricultural Chemistry, where for some years it has been used for rapid determination of organic matter in the soil.

It would therefore seem not out of place to direct attention to its utility for chemico-pedological purposes and to give an account of certain modifications made in the apparatus, to render its construction easier and use easier and more certain·

The apparatus (Fig. 19) consists of a tube *a* of transparent quartz closed at one end, of an inside diameter of 25 mm and a length of 240 mm. The tube is closed by a rubber stopper *e*, which is perforated by a metallic tube *b* of nickel, bearing on the one side a rheophore *g* and on the other a pipette *h* which conducts the combustion gases to the absorbing apparatus. Through this tubing passes a small quartz tube *d*, of an external diameter of 5 mm. and a length of 280 mm. The upper end of the quartz tube terminates in a bulb *n*, which isolates this metallic part from a second tubing *c*, also of nickel, furnished laterally with a rheophore *l* and internally soldered to a silver wire *m* of a diameter of 1.5 mm., which runs through the whole length of the lower metallic tubing and the small quartz tube. The two sets of tubing and the upper end of the small quartz tube are held together by a rubber tube *f*.

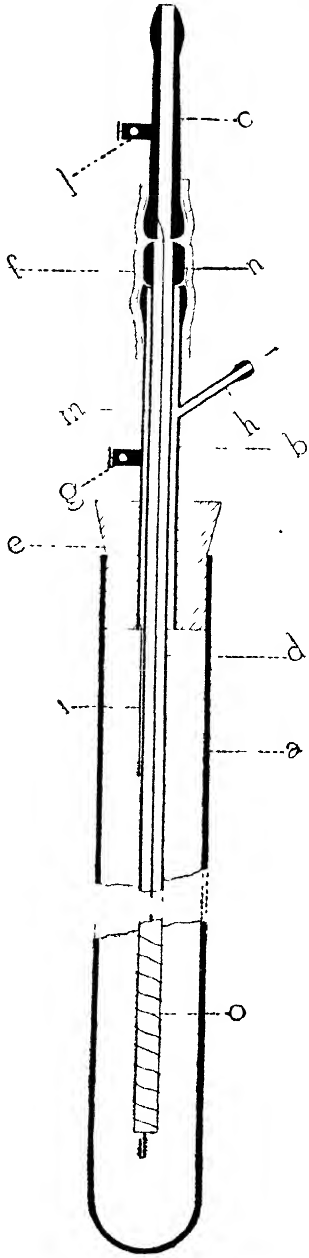

FIG. 51 — The CARRASCO-PLANCHER Apparatus for the elementary analysis of organic substances in the soil

To the lower end of the silver wire is attached, by means of a platinum joint, a resistance coil *o* of platinum of a diameter of 0.35 mm., which is wound in a spiral on the outside of the small quartz tube until it reaches a second platinum wire *i*, soldered internally to the lower metallic tubing (2).

The analytical process for the determination of the organic matter in the soil is as follows :— Gm 0.5-5 of soil (to set free about gm. 0.2 of CO_2) are mixed in a mortar with gm. 1.5-15 of oxide of copper and with a little chromate of lead placed in the quartz tube.

If the soil contains carbonates it should be subjected to a preliminary treatment with warm dilute phosphoric acid, so as to drive off the carbon dioxide of the carbonates.

The stopper is fastened and the spiral is heated red-hot, then the CARRASCO-PLANCHER apparatus is connected with the absorbing apparatus; the current of oxygen is passed, heating at the same time the lower end of the quartz tube with a MECKER lamp.

Combustion is completed in about half an hour. A carbon content of 58 % is attributed to the organic matter in the soil (humus); multiplying the weight of the carbon anhydride by 0.273 we therefore get the organic carbon, and by 0.471 the organic matter in the soil.

PERICLE PARISI,

of the Laboratory of Agricultural Chemistry of the « Regio Istituto superiore agrario » of Milan.

NOTES.

(1) O. CARRASCO and G. PLANCHER. — On the new CARRASCO-PLANCHER method for determining the carbon and hydrogen in organic matter by means of electric incandescence. — *Gazzetta Chimica Italiana*, XXXVI, 1906, pp. 492-504.

(2) The apparatus is made by the firm ANGELO LIVRAGHI. Milan (28), Corso Como, 9.

Abstracts and Literature.

General.

Moor Science.

BÜLOW, K, v. *Moorkunde.* 142 pages. 20 illustrations. Sammlung Göschen. Vol. 916. Published by Walter de Gruyter and Co., Berlin and Leipzig, 1925.

The object of this manual is to state within definite limits and with reference to practical requirements the main principles of moor science so far as they can be said to be established. This is achieved in a commendable way, all purely theoretical or debateable subjects being omitted.

SCH.

Exact Soil Cultivation.

BURMESTER H. Die exakte Bodenwirtschaft.. A text-book for students and practical farmers. Published by Wilh. Gottl. Korn, Breslau.

The author has made soil cultivation the basis of a system of farming and explains in this book, basing his statements on his scientific experience of twenty years, the co-ordination of all the principles of "his exact soil cultivation", and the interaction necessary to bring about those high crop yields required by the needs of the present day from the farmer and from the farmland. The marked successes achieved by the author in the capacity of agricultural consultant, together with the practical advice he gives for securing large crops with comparatively little application of labour or fertilisers and a minimum of seed, give this book great value as indicating new departures in agricultural science.

SCH.

The Methods of Geology as a Historical and Biological Science.

WALTHER, JOHANNES. Fasc. 185 of the "*Handbuch der biologischen Arbeitsmethoden* (E. ABDERHALDEN)" Part X, 5. 15 illustrations. 1 Table. Published by Urban and Schwarzenberg. Berlin-Vienna, 1928.

This well-known writer gives in this work a comprehensive review of the process of formation of the earth's crust, as revealed by the rocks and the fossils found in them, as well as by the earth forms, both tectonic and superficial.

SCH.

Problems of the Earth and their Solution by the Law of Transformation of Energy.

ZUNKER F. Published by the Journal "*Der Kulturtechniker*" 9 illustrations. 1925.

It is impossible to review, or to discuss critically in the short space available, this book, dealing as it does with the important problems of the

origin of the earth, but very careful study may be recommended of a work which goes so deeply into these scientific questions. SCH.

Soil Physics.

Alkali Soil Investigations. Origin of Alkali Soils ; Physical Behaviour under Treatment.

JOFFE J S and MCLEAN H C *Soil Science*, vol XVIII, no. 1, pp 13-30, Baltimore, 1924.

With due regard to the views of other workers the authors discuss the problems and the treatment of alkaline soils. The effects of the treatment of alkaline soils with alum and with peat, and the results of the oxidising action of sulphur, are discussed, particularly with regard to the rise of capillary water in the soil L. G.

Contribution to the Knowledge of the Physical Properties of Soils.

SOKOLOWSKI H N and LUKASCHEWITSCH E S (Communication from the Laboratory for Soil Science of the Moscow Agricultural Academy) *Uspechi Agronomii*. — Progress of Agricultural Science (formerly *Izwestija Selsko-chosjaistwennoj Akademii* Yearbook of the Moscow Agricultural Academy), Vol I, pp 47-58, 1925)

The purpose of the investigation was to find the influence of salts on certain properties of soils. The experiments of K. K. GEDROIZ (1) and A. N. SOKOLOWSKY (2) have clearly proved that in this case the effect is not due to the salts themselves, as was formerly supposed, but to the cations absorbed by the soils. Thus the phenomena which we are investigating are closely bound up with the absorbent powers of soils.

In our experiments, 50 gms. of tschernosem (from the Kharkov Experiment Station, upper layer, 0.20 cm.) was placed on a funnel and washed with one per cent. normal solutions of NaCl, $MgCl_2$, $FeCl_3$ and with 0.05 % normal solution of HCl (after GEDROIZ). This washing was continued until the filtrate no longer gave the Ca reaction, and in this way the soil samples were saturated with different cations. During the filtration of the $FeCl_3$ solution a change of colour from yellow to red-brown was noticeable.

The soil has thus a considerable (catalytic) accelerating effect on the reaction $FeCl_3 + 3\ H_2O \rightleftarrows Fe\ (OH_3) + 3HCl$, The excess of reagents was removed from the sample by washing, but in the case of samples treated with NaCl and NH_4Cl, as it was not thought possible to use dialysis, the excess of reagents was removed by washing on a parchment-paper filter under diminished pressure. But it proved impossible to remove the

(1) *Russian Journal of Experimental Agricultural Science* 1908-1923

(2) *Moscow Agricultural Academy* 1919, *Intern. Mitt f. Bod.* 1923; *Journal of Experimental Agricultural Science* 1921-1923.

last traces of NaCl as the filtration through the parchment-paper soon stopped. All samples were then dried (at 11° R).

The soil samples had the following appearance: those saturated with Na and NH_4 were hard, compact lumps, and the samples saturated with $CaCl_2$ and $MgCl_2$ solutions and particularly those samples treated with $FeCl_3$ and 0.5 normal HCl were loose and crumbled easily. At the same time and for comparative purposes a sample was prepared which had been washed with distilled water only and dried.

In the pressure-resistance experiments it was found very difficult to prepare test samples (test-cylinders) which would give, on crumbling, comparable numbers. At last, to ensure a uniformity of the test samples we used the following method: 10 gm. of soil, rubbed into a fine powder, were poured through a wide funnel into a glass-tube (6 cm. long and 2 cm. wide), particular care being taken that the upper surface should always be horizontal and the tube had been tapped with the finger. The soil samples thus prepared, were then saturated with water through capillary action and pushed out of the tube by means of a wooden piston The soil cylinder was cut to about 3 cm. length, dried at 100° and crushed on Prof. Williams' apparatus. The following results were obtained:

Complete crushing of normal soil samples:

7,95; 8.85; 8.40; 8.85 kg. Mean 8.54 kg. Amplitude 15 %.

We also prepared test cylinders of soils, which had been saturated with different solutions by means of the above method, and also determined their resistance to pressure.

The capillary rise of water up to a height of 3 cm. took place in the different cylinders with different speeds.

	The Normal experiment with 0,99 % of displaceable $Ca^{\cdot\cdot}$	The absorption capacity is saturated with the following cations					
		$H^{\cdot}$	$Fe^{\cdot\cdot\cdot}$	$Ca^{\cdot\cdot}$ (1.1 repl.)	$Mg^{\cdot\cdot}$	$NH_4^{\cdot}$	$Na^{\cdot}$
Rate of rise of water	3.5 mins.	2 mins.	2 mins.	3.5 mins.	5.5 mins.	10 hrs	After 2 days 1 2 cm.; After 1 month 3 cm
Water-capacity (in weight per cent.)	44 %	43 %	41 %	43 %	42 %	43 %	—

As the soil samples saturated with $Na^{\cdot}$ behaved very peculiarly while saturating with water, the water becoming strongly coloured by dissolved humus, a different method had to be to devised for their preparation. A glass-tube was therefore filled with soil saturated partly with $Na^{\cdot}$ and partly also with tschernosem which had been kneaded with water (after ATTERBERG).

The soil cylinders prepared in this way were dried at the ordinary

temperature in a vacuum desiccator over concentrated sulphuric acid, all changes which high temperatures produce in soil colloids being thus excluded. (The resistance to pressure of normal soil samples dried at 100°, was nearly half that of samples dried at ordinary temperature).

With the apparatus of Prof WILLIAMS we obtained the following results as to the resistance under pressure of our different soil samples :

	Sample cylinders prepared by our method						Samples according to ATTERBERG	
	Unchanged samples	Samples saturated with cations of					Unchanged	Saturated with Na
		Ca	Mg	H	Fe	NH_4		
Appearance of cracks	8.85 kg 9.3 "	6.0 7.5	10.5 —	2.3 2.1	0. 5 0.75	—		
Complete crushing .	15.0 " 16.5 "	10.2 11.7	29.3 30.5	4.5 4.8	3.[illegible] 3.3	— 0.5	30	Not crushed even by a weight of 150 kg

Taking the resistance to pressure of a normal sample of blackearth (*tschernosem*) as 100, we get for the soils saturated with different cations the following numbers:

Saturated with	Fe	H	Ca	Mg	NH_4	Na
Resistance to pressure .	[illegible]	30	70	180	140	140

In the action of 0.05 n. HCl we are undoubtedly dealing with the influence of the H on the soil colloids as well as with the influence of the $Fe^{\cdots}$ extracted from the soil.

Only in this way can we explain the remarkable similarity of the results obtained in the case of soil samples treated with either 0.05 n. HCl or 1.0 n. $FeCl_3$ solutions. In both cases not only the $Fe^{\cdots}$ ion but also the iron oxide soil is active, and the coagulating action of the latter is not removed even on washing with soda.

We have also determined the plasticity and the capacity of our soil to be rolled out. The samples saturated with $Na^{\cdot}$ gave on rolling a thin, elastic ribbon which could be bent very easily, while the soils saturated with $Fe^{\cdot\cdot}$ gave, on the contrary, very fragile thick cylinders. The normal sample and those formed with soils saturated with $Ca^{\cdot\cdot}$, $Mg^{\cdot\cdot}$ and $NH_4^{\cdot}$ were average in this respect and no noticeable differences were remarked among them.

Similar results were obtained in the water-content determinations when the limit of rolling has been reached.

Soil sample saturated with	Na·	Normal sample	NH$_4$·	Ca··	Mg··	Fe···
Water content (Limit of rolling) .	21.9	25.1	27.1	27.8	28.3	28.8

Summary: —

(1) The absorbed cations have a different effect on the physical properties of the soils which absorb them.

(2) The resistance and plasticity of a soil are increased by replacing the absorbed Ca·· by Na· somewhat less so, if replaced by NH$_4$· But if the Ca·· ion is replaced by Fe··· these properties are not very strongly marked.

(3) The capillary properties of and the rise of capillary water in a soil are inversely proportional to its resistance to crushing.

AUTHORS.

The Mechanics of Earth Structure from a Soil-physical Basis.

TERZAGHI K. 399 pages, 65 illustrations Published by Franz Deuticke, Leipzig and Vienna, 1925

This work is of greater value to the soil scientist than the title would seem to indicate It is based on A. ATTERBERG's researches into the physics of the soil, but it also contains the results of the author's own researches in the same subject, which undoubtedly constitute a contribution to science.

This applies particularly to the following chapters: Structure and pore volumes of soils; thermal properties of soils; consistency and coherence of soils; the frictional forces in the soil; the caking tendency in binding soils; the water content of air free clayey soils, as a function of the loading of the soil surface; the relation between loading and the pore index of sands when there is no possibility of lateral expansion; the adhesion of binding soils; the relations between the tenacity indices, the internal pressure and internal frictional resistance; the permeability of soils; the statical effects of running ground-water; the capillary rise of soil-waters; the evaporation of the soil-waters from the surfaces of clay layers; the thermodynamical equation to express the time course of hydrodynamic tension phenomena; approximations for the numerical treatment of tension balance in binding soils.

The last two chapters on " soil statics " and on " the soil as building land " are of special interest to engineers.

A brief mention only can be made here of this important work, which contains the tabulated results of numerous experiments. It should be in the hands of all soil scientists.

I. STINY.

Chemistry and Agricultural Chemistry of the Soil.

The Estimation of Nitrate Nitrogen in Rain-water, Drain-water and in the Soil.

HANSEN F. Om Bestemmelse af Nitratvalstof i Regnvand, Dranvand og Jord (*Tidskrift for Planteavl*, Vol 32, p 69-119, 1926).

The author has investigated the different methods of nitrate nitrogen estimations and recommends the " Devarda " method, in the modified form, as devised by the chemical laboratory of the Rothamsted station. The Phenol-sulphonic method gave too uncertain results. No doubt, for rapid estimations, the phenol method is the best, but to get accurate results not more than 0.1 gm. of nitrate should be used, and the results obtained should be corrected by the formula

$$N = 1.06\ N\ (\text{found}) + 0.33.$$

The investigations show that the nitrate concentration of drain-water is largely influenced by the precipitations. The nitrate concentration falls very considerably after a heavy rain and rises to its normal value in dry weather, until fresh precipitation again disturbs the equilibrium.

This article is a communication from the Askov Experiment Station, where the laboratory analyses of soil samples prove that nitrification is more intensive on plots treated with stable manure than on those treated with artificial fertilisers. K. A. BONDORFF.

Comparative Experiments on Different Methods of Estimation of Phosphoric Acid in Soils.

HISSINK D J with collaboration of DEKKER M (Vergelijkend onderzoek van eenige methoden ter bepaling van het gehalte aan phosphorzuur in de grond. Published by the *Landbouwkundige Onderzoekingen der Rijkslandbouwproefstations*, No. XXX, pp. 142-161, 1925.

Three typical soils were chosen (clay soils with different contents of humus) and their phosphoric acid content was determined by a large number of the usual methods. The following are the conclusions drawn from the results obtained.

(1) The separation of silicic acid has no influence on the results.

(2) In the case of not heating to a red heat, the fact of destruction or not of the dissolved organic matter present in the soil is of great importance in the determination.

(3) Heating of the soil to red heat gives in all cases and with all methods higher figures.

(4) In the case of soils not heated to a red heat where the organic matter has been destroyed, the nature and strength of the acid, the quantity of soil used and the length of boiling are of the greater importance the more humus the soil contains. The importance of these factors is slight in the case of soils heated to redness where the boiling has been continued for some time.

After a critical review of the data obtained the following two methods A and B were adopted.

A. *Determination of the phosphoric acid soluble in acid.*

12.5 gm. of air-dried soil were rubbed to a fine powder and heated to redness in a platinum dish over a small flame for 5 hours, stirring it from time to time. The soil was then transferred into a 250 cc. flask and shaken up with 150 cc. of HNO_3 (12.5 %) and then heated in a glycerine bath for 75 minutes to a temperature of 105° C, the flask being shaken from time to time. When shaking the flask the glycerine in the bath was diluted with a little water. After the heating is completed the flask was cooled and the 5 cc. of conc. H_2SO_4 were added and the flask rapidly cooled. The flask is filled with water up to the mark, stirred and filtered. 50 cc. of filtrate are next taken and the phosphoric acid is determined by LORENZ's method by adding 50 cc. of molybdenum-sulphate reagent, and, after allowing to stand over-night, filtered through a NEUHABER funnel. The residue is washed on the funnel with NH_4NO_3 and acetone and dried for half-an-hour in vacuo. The volume of the soil is taken into account.

B. *Determination of the phosphoric acid soluble in citric acid.*

55 gm. of soil, air-dried, finely powdered, but not heated to redness, are digested at room temperature in the course of 48 hours, with repeated shaking, with 500 cc. of a 2 % citric acid solution. In the case of soils containing $CaCO_3$ 500 cc. of a stronger citric acid solution were used. 200 cc. (in the case of soils with more than 5 % $CaCO_3$ only 100 cc. of soil were used) were then evaporated in a porcelain evaporating dish on a water-bath and to oxidise the citric acid 5 × 10 cc. of NHO_3 (sp. gr. 1.4) were added. To prevent splashing the water-bath should not boil too vigorously. The residue is dissolved in 10 ccs of 10 % HNO_3 and in some hot water and filtered while still warm into a beaker, and evaporated to about 15 cc. on a water-bath. 35 cc. of a H_2SO_4-HNO_3 mixture are added (LORENZ) and while the solution is boiling the P_2O_5 in it is precipitated by the addition of the molybdenum-sulphate reagent (LORENZ).

The relative solubility of the P_2O_5 is equal to B : A.

v. d. S.

Investigations on the Influence of Calcium Carbonate on the Reaction of a Soil.

JENSEN TOVBORG S (Undersøgelse over Kalciumkarbonats Reaktionsändrende Virkning i Jordbunden. *Tidskrift for Planteavls.* Vol. 31, No. 7, pp. 744-777, 1925).

The author set himself the problem to find whether it is possible to determine from the titration curve of a soil the quantity of lime to be added so as to bring its hydrogen ion concentration up to pH = 7.0. In this enquiry he relied to a great extent on his field experiments with graduated applications of lime which he had carried out over a number of years. The result of his laboratory experiments is briefly, that, to ascertain the quantities of lime required in actual field practice, the quantities calculated

from the titration curve (titration with $CaCO_3$) must be multiplied by the factor 3. He also finds that sandy soils require larger quantities of lime than loamy soils, to obtain the same rise in pH, and that there is a rough relationship between the pH existing at the moment and the amount of lime required for reaching pH = 7.0. He emphasises also very strongly that it often happens that very different quantities of lime may be needed on soils with the same pH to bring about the same reaction change. Thus two sandy soils, both of pH = 5.8-6.0, required, one 3000 kg. of $CaCO_3$ per hectare, the other as much as 32,500 kg. per hectare to bring the pH up to 7.0. Details cannot be given here, but the attention of soil scientists generally is drawn to this memorandum and it may be confidently asserted that with this work of the State Plant Cultivation Laboratory a new epoch begins in the study of the liming question. K. A. BONDORFF.

Alkali Soil Investigations: Chemical Effects.

JOFFE, I. S. and MCLEANS H C. *Soil Science*, Vol. XVIII, No. 2, pp. 133-149. Baltimore, 1924.

The question is discussed how much sulphur has to be used to change the character of the alkaline soils, or to neutralise the soda which is either present or is being formed. The authors discuss also the question of the treatment of those soils with either alum alone or combined alum and sulphur. L. G.

On the Decomposing Action of Peat on Phosphorite.

PRIANISCHNIKOW D (Moscow). *Fortschritte der Landwirtschaft*, I, No. 1, p. 1. Vienna, 1926.

The author first draws attention to the researches of FLEISCHER, KISSLING, KNIERIEM and others which proved that high-moor peat possesses the property of decomposing phosphorites, and that the quantity of phosphoric acids dissolved is increased by an admixture of the neutral salts of strong acids. Ca salts however in comparison with the K, Na and NH_4 salts tend rather to reduce such quantity, although in the opinion of the author this is only the case when the non-saturation of the peat, expressed in Ca, has passed a certain limit. With these conclusions in view the author carried out a number of experiments, which proved, that the acidification produced by the addition of $CaSO_4$ is larger than on the addition of KCl, and that the highest acidification i. e. the largest increase in the water soluble P_2O_5 occurred in the mixtures peat + phosphorite + $CaSO_4$ (pH = 4.0 against peat pH = 6.1). If 100 gm. of peat contained 0.01 gm. of water-soluble P_2O_5, then in the mixture it rose to 0.326 gm. This was the maximum figure for all experiments. On being allowed to stand the phosphorite solubility sunk from 46.17 % at the beginning to 29.17 % after four months. In the meantime about 63 % of the P_2O_5 in the phosphorite have been decomposed, because the $CaHPO_4$ formed has no effect either on the acidification or the solubility of the P_2O_5. If the ratio of phosphorite to peat is very large, e. g. 1:100,

the solubilities are even more favourable. Hence the question arises: could we not obtain the effects of superphosphate fertilisation if in its stead we supplied to the soil a mixture of 12 parts of 25 % ground phosphorite together with six parts of gypsum and 600 parts of ground peat? And in fact sand cultures of oats (according to HELLRIEGEL) showed an exceptional utilisation of the phosphoric acid in the peat-phosphorite mixture. In the crops were found the following percentages of P_2O_5: without phosphorus: 0.10 %; phosphorite alone: 0.14 %; peat alone: 0.21 %; peat and phosphorite: 1.21 %; complete nutritive solution of HELLRIEGEL, 0.51 %. H. FISCHER.

Some Properties of Soil Colloids.

SOKOLOVSKI A. N. *Izvestia Petroskoj Selskochosjajstv. Akademii* 1919, *I-IV*, 85-275. *Moscow.* (Annals of the Agricultural Academy 1919 I-IV. Moscow)

The colloid part of the soil is its active fraction which determines the composition, physical and chemical properties and morphological character of the soil, that is, the nature of its profile.

Also the absorptive power is a function of the quantity of colloid clay and humus.

In connection with the condition of soil formation the profiles of different soil types show quite characteristic curves of distribution of absorptive power, from top to bottom. The maximum of absorption in relation to ammonia is shown by black soil (tschernosem), with great decrease to N. and S. from the black soil belt.

The acidity of soils depends mostly upon a low degree of saturation of soil colloids with lime.

The amount of clay and of humus and also the structure of the soil, are in close connection with absorbed lime.

The possibility of the formation of black soils depends generally upon the content of lime in soil-forming deposits. In this relation an exceptional role belongs only to absorbed lime. The soil represents a system of unstable equilibrium between its colloids and absorbed lime. After removal of lime and washing with water striking changes take place: destruction of the crumb structure, swelling, reduction of its filtration-capacity, of consistence of the soil, and finally dissolution of soil colloids (black solutions from tschernosem).

These phenomena play a great part in nature to the North of the tschernosem belt, under the action of water, in combination with CO_2 and some other acids, as also in Southern (SE) countries, in the soils of which the losses of lime are due to replacement by soda.

Also, the content of absorbed lime is a regulating factor as regards the chemical as well as the physical properties of the soil.

The colloidal part of the soil is divided into two fractions: one, which is in continuous unstable equilibrium with absorbed lime and the other which is not connected in its properties with lime, but represents an insoluble combination of clay and humus; separation of that fraction from soil

is possible only by boiling with water (very incomplete) or, better by oxidation by means of H_2O_2. Those fractions are termed: active and passive slime (clay + humus). The former, containing absorbed lime, is a factor in good structure. This active slime is relatively great in black soil and very small in podsol, in close relation with lime content and physical properties of those soils. It is an analogue of " matière noire " when in a more natural state without the changes necessarily effected by the action of strong chemical reagents. Its importance for soil fertility depends in the first instance upon its influence on the physical properties of soil.

These phenomena form a basis for elaboration of a method of mechanical analysis of soil for the determination of conditions of good structure in our soils. The enormous importance of absorbed lime compels us to study not only its proportion in different soil types but even more the degree of relative saturation of soil in regard to lime. The top layers of black soil are most saturated by lime; lime is partially replaced by magnesium; sodium and potassium are not present in the absorbed state. In soils of semi-desert regions and especially in alkali soils, the degree of saturation by lime is very small because lime is replaced to great extent by sodium and magnesium.

The coefficient by expression of degree of saturation is calculated in this manner: coefficient = $\frac{am}{ka}$ (*am* and *ka* are proportions in which NH_4 and Ca are absorbed by soil from equivalent solutions of their chloride expressed in m-mol. for 100 gm. of soil). Different soil types have their own individual curves of changes of this coefficient in their profiles. This fact is a useful indicator of origin of soils or geological deposits.

The strikingly low degree of saturation of South-Russian loess (in spite of high $CaCO_3$ content) and enormous absorptive capacity in relation to lime is of great importance when attempting to form hypotheses of the origin of those deposits.

The absorbed lime influences to a great extent the absorption of P_2O_5. The process of displacement of absorbed bases and that of passing into solution are in the opinion of the author which differs from that of M. Parver, qualitatively quite different; (by the action even of weak HCl solutions, Fe_2O_3 and P_2O_5 pass into solution). This may occur as a secondary phenomenon in the case of unsaturated soils. AUTHOR.

The Calcium Content of a Soil in Relation to its absolute Reaction.

Swanson C O, Grainey, P L and Latshaw, W. L *Soil Science*, Vol. XVII, no. 3, pp 181-191. Baltimore, 1924

The contribution deals firstly with the investigation of 293 soils of very different geological origins. The acidification of soils is primarily due to the removal of bases by washing-out in the process of weathering, the weathering process being hastened largely by the presence of organic substances in the soil. The soils were investigated in the following way: 25 gm. of soil were agitated in a shaking-machine, for several hours with

250 cc. of HCl in a 500 ccs. flask. The soil was then allowed to settle and, in three samples respectively: (1) the time was quantitatively determined, (2) the Hydrogen-ion concentration was measured, and (3) a nitrogen bacteria test was taken. The results show that there exists a relation between the calcium content and the pH index of soils of approximately the same physical character and of similar climate, and also, that in many cases the nitrogen-bacteria test reacts similarly. But the authors are of opinion, that in the case of unknown soils conclusions should not be drawn from results obtained from a single one of the three tests, and advise the carrying out of all three tests in all cases.

L. G

Ground-water Movements and Stagnation Processes explained by Oxygen Analyses of the Ground-waters of North Swedish Moraines.

TAMM O (Swedish, with a full German review) *Meddelanden från Statens Skogsförsöksanstalt*, 22, p 1 Stockholm, 1925.

The North Swedish soils are covered in their greater part by peat. As already shown by HESSELMAN, water which has trickled through a layer of peat is free from oxygen On the other hand, the water of normal moraine soils is rich in oxygen By means of a mercury pump and of a specially constructed boring apparatus, the author was able to obtain water samples from different depths of moraine soils. In the process of pumping these water samples lose only very small quantities of the dissolved gases and the oxygen present was determined by WINKLER'S method. It has been found, that while there are peat soils with moraine ground-waters free from oxygen beneath the peat, on the other hand there are peat-soils with ground-waters rich in oxygen. It was found that the moraine ground-waters under the peat of the fringes of peaty soils were always rich in oxygen, while on the same spot the waters of the lower peat layers were completely free from oxygen. By means of a large number of oxygen determinations in water samples taken from the fringes of peaty soils and from different depths and soil profiles, it has been afterwards possible to tell more or less exactly whether the given sample of ground-water came from a spot covered by, or free from, peat. Thus the determination of the oxygen content of samples of ground-water furnishes a means of determining the movements of the ground-water and consequently the process of stagnation. The analyses carried out gave data as regards these phenomena. O. TAMM.

Experimental Studies on Chemical Processes on the Formation of Glacial Clay.

TAMM O. *Experimental Studies on Chemical Processes in the Formation of Glacial Clay.* (English). *Sveriges geologiska Undersökning.* Årsbok, 18 (1924), No. 5, Stockholm, 1925.

The glacial clays have been formed through the grinding of rocks (in Sweden very often granites and gneisses) by the melting of interstitial

ice, i. e. through wet grinding. The water formed by the melting ice must also contain dissolved carbon dioxide. The process is from a physico-chemical point of view very similar to the well known DAUBRÉE experiment. DAUBRÉE ground felspar in water, the liberated silicate being chemically decomposed to a large extent. The author carried out a number of experiments by rotating quartz flasks in a thermostat, the flasks containing a number of very small pieces of granite, pea-nut size or smaller, and also water, either free from or containing carbon dioxide. The granite was analysed very carefully. The rotation caused the pieces to rub against each other resulting in formation of clay. After 12 hours rotation the liquid was titrated and the dissolved bases estimated.

First were studied the general conditions of granite decomposition. As expected, the rate of decomposition was very nearly independent of the temperature, but depended to a large extent on the intensity of grinding and on the quantities of carbon dioxide (= H· ion concentration present).

In two parallel experiments carried out on a larger scale, with and without carbon dioxide, the products, which were in one case clay and silt, and in the other dissolved salts, were investigated very carefully. The clays thus prepared are very similar to the natural glacial clays even as regards their chemical composition. The dissolved bases ($MgO + CaO + K_2O + Na_2O$) represented, in water containing carbon dioxide, 3.24 %, and, in water free from carbon dioxide, 1.17 % of the clay formed at the same time (< 0.002 mm).

The author was then able to calculate the content of the two clays in chemically dissociated minerals He found: for the experiment with carbon dioxide 15,6 %, for the other 6,0 %. The analyses indicate a higher content in biotite in the clays artificially formed.

Some experiments with potassium felspar also indicated a large decomposition. This mineral must therefore also play an important part in the chemical processes taking place in the change of granite into glacial clay.

These experiments throw light, in some respects, on the chemical processes, taking place in the formation of glacial clay, and furnish a method which may enable us to clear up the processes of hydrolysis and decomposition of the silicate minerals. O. TAMM.

Biology of the Soil.

The Bacteriological Sulphur Oxidation in Pond Soils and its Practical Importance.

FISCHER H. *Zentralblatt für Bakteriologie*, II, p. 35, 1925

The formation of SO_4'' ions in pond waters and in pond soils appears to be of the greatest practical importance, as by their means we may be able to recover from the soils the insoluble phosphates lying there inactive. It has been found necessary in all pond manuring experiments to introduce PO_4 ions into the water and in most cases, this has been done by using either

different sulphates or fertilisers physiologically acidified by means of SO_4, but it can be brought about just as well by natural bacterial sulphur oxidation. This sulphur oxidation is chiefly caused by autotrophic micro-organisms. Their action is facilitated by alkalinity of the soil and of the water, and inhibited by acidity of these media. The experiments were made with pure sulphur, sulphides, thiosulphates, sulphites and sulphuretted hydrogen. From all these sulphur compounds considerable amounts of sulphates were obtained by means of bacteria. But under certain circumstances, e. g. in sewage sludge, there takes place a reduction of sulphites and thiosulphates to sulphides. In the case of weighing experiments by passing through a current of air and sulphuretted hydrogen, with the calcareous soils only energetic oxidation took place and retention of sulphur as newly-formed sulphates. In the event of weak oxidation the sulphuretted hydrogen passed through the vessel with the soil and soil suspension and then passed through attached flasks containing a caustic soda solution. In all experiments, about 10 % of the sulphuretted hydrogen could not be recovered. This percentage must have been retained in the soil either biologically or by purely chemical action.

AUTHOR.

The Influence of Hydrogen-ion Concentration on Bacteriological Processes.

GERRETSEN F. C. Over den invloed van de waterstofionen concentratie op bacteriologische processen. Verslagen van *Landbouwkundige Onderzoekningen der Rijkslandbouwproefstations*. No. XXX, pp. 1-44, 1925.

In the determinations of the hydrogen-ion concentration in biological solutions one is restricted almost solely to the use of the colorimetric method.

The author describes an arrangement called by him a bicolorimeter by which the pH may be exactly determined without the use of a "buffer" solution even in small quantities (0.25 cc.) of solution whether coloured or turbid.

For less exact determinations an ordinary colorimeter was devised using a small basin, which contains the different indicators in the yellow (acid) form and in sufficient quantities.

The pH values obtained by this colorimetric method in the case of centrifuged aqueous soil suspensions were sufficiently in agreement with the values obtained by the electrometric method with the same suspensions to justify its use in practice for pH determinations. The pH values of soil extracts obtained by PARKER's method of filtration or percolation are unreliable. With regard to the influence of the hydrogen-ion concentration on the nitrite and nitrate bacteria, the author's experiments prove. that in culture solution the nitrite formation lies between pH 5.6 and 9.7 with an optimum between 7.8 and 8.2; the limits of nitration lie between pH 5.2 and 10.0 with an optimum between pH 8.3 and 9.2. However, the limits of nitration appear to be conditioned by the character and

place of origin of the bacteria. It has been found in addition that the influence of the hydrogen-ion concentration on bacteriological processes depends to a large extent on the mode of preparation of the culture medium.

Experiments with soil suspensions and soils proved that in those media nitrification may bring about much lower pH values (as low as 3.5) than in pure cultures, and moreover that nitrification depends not so much on the number of bacteria, as on the original pH value and the extent of the buffer action of the soil.

In the author's opinion it is possible by means of nitrification experiments to conclude up to what point $(NH_4)_2SO_4$ may be added to a soil before it becomes acid.

In alkaline soils there may occur an accumulation of nitrite because of the slowness of nitrification. This accumulation of nitrite as well as the process of formation of the nitrite itself are influenced to a large extent by the water content of the soil

In conclusion the author proves by means of experiments that in the process of nitrification both in the soil and in culture solutions an acid is formed which is capable of dissolving insoluble phosphate. Whether this dissolving does take place depends on the amount of acid, on the original pH value and the extent of buffer action of the soil. v d. S.

Alkali Soil Investigations: Chemical and Biological Effects of Treatments.

JOFFE I S. and McLEAN, H. C. *Soil Science*, vol XVIII, no. 3, pp 237-251 Baltimore, 1924.

The authors describe, in respect of the soil solutions of variously treated alkali soils, the reaction, the content in plant nutritive material, and the bacterial numbers. The influence of each soil on plant growth is also indicated L. G.

A Contribution to the Biology of the Thiosulphate Bacteria.

KLEIN G. and LIMBERGER, A. *Biochemische Zeitschrift*, Vol. 143, p. 473, 1923.

Bacteria can live aerobically on inorganic as well as organic nutrients. They are capable of oxidising all forms of sulphur, and potassium nitrate is reduced by their action to nitrite and ammonia. Ammonium chloride also yields nitrite. Sulphur was deposited as rhombic crystals.

H. FISCHER.

Investigations into the Importance of Tree Mycorrhizae.

MELIN E. An ecological-physiological Study. With 48 illustrations in the text. Published by G. Fischer. Jena, 1925.

Contents : The state of our knowledge about the root fungi of trees ; the root fungi in pure culture ; tree seedlings in pure culture ; tree seed-

lings and fungi in pure culture; conclusions as to the mycorrhizae of the conifers in nature; tables; literature. SCH.

The Relation between the Nitrogen-bacteria Test of a Soil and its Reaction Character.

PETERSEN ERIK, I. Undersøgelse over Forholdet mellem Azotobacterproven og Jordens Reaktionstilstand. *Tidsskrift for Plantaeavl*, Vol. 31, pp. 246-336, 1925.

The nitrogen-bacteria test discovered by H. R. CHRISTENSEN was, as is well-known, of great importance in the investigation of Danish soils, the non-appearance of nitrogen bacteria indicating a lime shortage. The author has made a very thorough and exhaustive study of all the different factors conditioning the results of the test He concludes that such results are influenced not only by the buffer action of a soil, but also by the nitrate content, the general microbiological structure and the quality of the inoculation material The author lays special stress on the fact that it is impossible with ordinary inoculation to equalise the differences in the microbiological character of different soil samples, and he therefore suggests omitting the nitrogen bacteria test in future experiments and instead taking a titration curve of the soil and thence determining the lime requirements. The article is contributed from the State Plant Cultivation Laboratory. K. A. BONDORFF.

A Contribution to the Knowledge of Edaphic Mucorini in Jugo-Slavia.

PISPEK, A. (Prinos peznavanju edafskih mukorineja Jugoslavije). (Croatian with a review in French *Acta Botanica Instituti Botanici R. Universitatis Zagrebensis*. Vol I Zagreb, 1925.

Taking as basis HAGEM's and LENDNER's researches on mucorini the author investigated 270 soil samples from 200 different localities. He was enabled to isolate 40-50 different varieties. The soil samples were taken from the following different districts of Jugo-Slavia: Croatia, Slavonia, the Croatian Coast-land, Dalmatia, Herzegovina, Vojedovina Slovenia and Serbia The soil mucorini varieties recognised by him with certainty were: *Mucor Mucedo, M. Ramannianus, M. flavus, M. racemosus, M. hiemalis, M. grisco-cyanus, M. sylvaticus, M. sphaerosporus, M. spinosus, M. circinelloides, M. Praini, M. stolonifer, M. Cambodja, M. arrhizus, Absidia cylindrospora, Ab. glauca, Ab. orchidis, Ab. Lichtheimi, Zygorhinchus Mölleri, Cunninghamella elegans.*

The author recognised many varieties of mucorini and considers that the occurrence of such a large number of varieties may be ascribed to the great heterogeneity of soil and climate in Jugo-Slavia. In the alpine districts, varieties are found which were isolated by LENDNER in Switzerland and particularly by HAGEM in Norway, e. g. *M. flavus, M. hiemalis, M. griseo-cyanus, M. stolonifer, Ab. cylindrospora, Ab. glauca* and *Ab. orchidis.* The other regions e. g. Karst, Pontic and Mediterranean regions are also distinguished by special varieties. In all these regions there are often

found representatives of the species *Cunninghamella* (2-3 varieties), more seldom of the species *Ab. Lichtheimi*. However, these three regions not only differ in their varieties from the Alpine districts, but they even differ among themselves. Thus, e g. *M. Mucedo, M. Ramannianus* and *M. arrhizus* have been found only in the Karst region, *M. Praini, M. Cambodja,* and several not yet recognised varieties of the species *Absidia, Cunninghamella* and *Zygorhinchus* in the Pontic region only, and two varieties of the species *Cunninghamella* only in the Mediterranean region. In addition, these three regions are each characterised by the occurrence in them of preponderating numbers of one or the other common variety, thus the Mediterranean region is characterised by *M. stolonifer*, the Pontic region by *M. circinelloides* and the Karst region by *Ab. cylindrospora.*

In general, the most widely distributed variety on Jugo-Slavian soil is *M stolonifer* (about one-quarter of all samples) and the least frequent are *M. Mucedo, M. spinosus* and *M. arrhizus.* After *M. stolonifer* these follow in the order of the frequency of their occurrence *Ab. cylindrospora,* then *M. circinelloides,* then *Cunninghamella elegans, M glauca, M. hiemalis* and finally *Ab. orchidis* and *Zygorhinchus Molleri.* The other varieties are very rare.

In a future scheme of further investigations Bosnia and Macedonia will be included. A SEIWERTH

Regional Soil Science.

Precipitation, Drainage and Evaporation in the Region of the Sources of the Weser.

FISCHER K. *Jahrbuch fur die Gewasserkunde Norddeutschlands* Vol. V. No. 3. 4 illustrations, 5 tables Published by E. S Mittler and Son Berlin 1925.

In this work the whole region of the sources of the Weser is dealt with in relation to rainfall, drainage and evaporation, excellent diagrams and maps being appended. Detailed studies of this kind are of the utmost value in connection with special work in geology or soil science

SCH.

A Contribution to the Knowledge of the Properties and Degeneration of the Soils of the Brown-earth Type in Southern Sweden.

LUNDBLAD K. (Swedish, with a resumé in German). *Meddelanden fran Statens Skogsförsökanstalt.* 21, p. 1, 1924.

The brown earth type (following the nomenclature of RAMANN) is characteristic of the beech forest soils of Southern Sweden. Where conifer woods are grown on beech forest soils, podsolation or degeneration of the brown earth occurs, and at the same time productivity diminishes. The author carried out a series of comparative chemical analyses on normal brown earth profiles and on brown earth profiles somewhat degenerated by growth of conifer woods, and compared the results obtained with those of the same tests on true podsol profiles. In some cases mass analyses

were made, in others the gel complexes of the soil were analysed by the TAMM method : extraction of the soil sample with a previously determined solution of a slightly acid mixture ($pH = 3.25$) of neutral and acid ammonium oxalate. By this method the gel complexes in sandy soils can be dissolved out and the solutions analysed for SiO_2, Al_2O_3 and Fe_2O_3.

While the podsol profiles indicate a quite definite maximum of gel complexes in the mother rock, the brown earth profiles usually show a uniform distribution of these in the upper soil layers down to a depth of 40 to 50 cm., when the content in gels begins to decrease. As soon as a slight degeneration could be detected, the analysis showed a gel complex distribution very nearly similar to that in genuine podsol profiles.

A live rock profile was also investigated for the gel complexes. It was proved that though the cementing was fairly hard there was no large content of gels. A number of other facts of interest, relating to the chemistry of soil formation in Sweden, are established by the author.

O. TAMM.

Certain Directions for the Drainage of North Swedish Peat Soils.
MALMSTROM C *Skogliga rön*. No 4, Stockholm, 1925.

From a peat sample newly taken from a moor there is very little, and in some cases no flow of water. The large quantities of water present in peat samples are thus present as hygroscopic moisture, and may so exist under three forms viz. either as capillary moisture or in a colloid-chemical form, or in a purely chemical form. Capillary water is only found in considerable quantities in the slightly humified peat varieties. The hygroscopic water of the strongly humified peat varieties is present in a chemical or colloid-chemical form, as can be readily shown

The permeability of the different peat varieties to flowing water is very different. The author has carried out experiments to determine the relative permeabilities of the different peat varieties. It appears that the strongly humified peat varieties are absolutely impermeable, in their deeper layers, to flowing water, while the deeper layers of the weakly humified varieties are permeable to considerable quantities of water.

In view of these properties of the different peat varieties it may be *predicted on theoretical grounds* that, where strongly humified peat varieties exist, two ground water levels (groundwater free water) will be formed. One exists in the upper, loose, layers of the peat and very often evaporates in summer, the second layers exist in the sandy subsoil (e. g. moraines) layers of the peat. On account of the loss of water by evaporation during the dry season this ground-water level can be found somewhat below the peat. In the case of the weakly humified peat varieties however only one ground-water level is formed, but it will be in constant communication, through the whole peat mass, with the ground-water of the sub-soil.

The above theoretical conclusions were confirmed by field experiments, in the case of the different peat varieties. On the basis of many exhaustive researches into peat soils, which to a large extent have already been pub-

lished (1), and taking into account previous experiments in the drainage of peat-soils, the author was able to give a number of theoretically and empirically established directions for the drainage of such soils. Many failures in the drainage of peat soils will it is hoped be prevented if when planning, care is taken to determine the structure and the permeability of the peat varieties, which can be easily effected by means of a quite simple field examination.

O. TAMM.

Researches on Soil Reaction and the Cartography of the Degree of Acidity, in the Fields of the Experimental Farm of the College of Agriculture and Sylviculture of Prague at Netluky Uhrineves.

NĚMEC A. and GRACANIN M. Studie o povaze a význam reakce půd a mapováui pozemku dvora Netluky školniho závodu vysoké zemědělsa kého a lesniho inženýrstir v Uhřiněvsi. Sborník Výzkumnýek ústavů zemždělských, Vol. VII. Edition. Ministry of Agriculture of the Czecho-Slovaýekian Republic at Prague, 1925. (With a review in French and one map)

In the present paper, the writers have studied the nature of the soil reaction on the Netluky experimental farm near Uhřiněves in Bohemia, attached to the College of Agriculture and Sylviculture at Prague. The results of these researches have been expressed on a chart of the reaction of the soils investigated. The reaction, varies from pH=5.8-7.5 in soils under cultivation, specially adapted for the growth of the sugar beet and wheat, and between pH = 6.1-7.5 in the grasslands. On the farm investigated no soils were found of extreme acidity. From the results of chemical analyses it appears that there is no precise relation between the total lime content and the soil reaction; however, the most acid soils contain the lowest amount of lime. It is possible to observe the influence of the manures applied during recent years on the reaction of the soil: — lands manured by means of physiologically alkaline manures (carbonate of lime, nitrate of soda, basic slag and farmyard manure) show a tendency towards a more basic reaction than those on which physiologically acid manures (sulphate of ammonia, kainit) have been applied in a preponderant measure. It should be remarked that superphosphate adjusts itself in the soil like a physiologically neutral manure.

By comparing the yields of different crops with the reaction of the soil some interesting relations can be established.

The yields of sugar beet on acid soil are found to be very inferior. With decreasing acidity of the soil, the yields of beet increase; on the more alkaline soils, however, they again decrease. Yields of wheat vary inversely with the acidity of the soil. Barley generally obeys the same law.

(1) C. MALMSTRÖM: Degere Stormyr. A botanical, hydrological developmental investigation into a North Swedish moor complex. Swedish and German. *Medd. fr. Statens Skogsförsöksanstalt*, XX, 1923, pp. 1-205. Stockholm, 1923.

Variation in the hydrogen ion concentration of the soil		Yield in quintals per *hectare* Sugar beet	Wheat	Barley
6.0	6.90	2[illegible]4	16	—
6.55	6.80	280	19	23
6.65	6.70	310	—	26
6.35	7.20	340	—	21
5.90 –	7.30	280	21	26
6.75 –	6.90	300	24	22
6.40	7.30	315	21	21
6.[illegible]0	7.30	280	—	23
7.15 –	7.50	300	22	26
7.10	7.40	245	25	—

Entirely different relations have been found for potatoes · the yields increase as the acidity of the soil increases —

Variations in the hydrogen ion concentration of the soil		Yield in quintals per *hectare* Potatoes	Oats	Rye
6.0	6.9	—	25	20
6.25	6.55	95	2[illegible]	20
6.75	6.80	—	24	—
6.75	6.90	—	—	22
6.70	7.30	50	21	—
6.80	7.25	50	—	22
7.10 –	7.40	40	22	21
7.10	7.50	[illegible]	—	—

On strongly alkaline soils (pH 7 5) the yield of potato tubers was particularly small

As regards oats, the highest yields were found on the most acid soils. Rye showed its capacity for giving good yields over the whole range of the soil reactions examined, the optimum yield however corresponds with the highest hydrogen ion concentration of the soil.

Investigation of the physical properties of the soils examined brought into prominence the relation of the degree of acidity or alkalinity of the soil with the absolute capacity for air, determined by Prof. KOPECKY'S method The most acid soils showed the lowest value of absolute capacity for air, whilst the optimum corresponds with very slight acidity of the soil (pH = 6.8.)

Thence, the increasing alkalinity of the arable soil is in inverse function to the absolute capacity. for air —

Reaction of the soil in pH	Absolute capacity for		Remarks
	moisture	air	
6.35	30.36	3.60	—
6.36	29.68	3.36	—
6.35	50.06	9.38	Grass land
6.40	49.34	10.41	Grass land
6.59	33.13	14.07	—
6.60	30.51	11.80	—
6,73	26.01	10.84	—
6.75	26.52	14.70	—
6.81	36.03	18.36	—
6.84	29.65	17.68	—
6.97	40.01	15.02	—
7.25	39.20	12.57	—
7.25	48.57	10.22	—
7.31	28.25	8.86	—

As regards porosity, the existence of similar, though less precise, relations between it and the hydrogen ion concentration of the soil can also be remarked.

The changes of physical properties and especially of the absolute capacity for air and porosity have a notable influence on the yields of agricultural crops.

The investigation of the relations of the soil reaction to the presence of weeds has shown interesting results. Weeds such as *Sonchus laevis, Veronica serpyllifolia, Sinapis arvensis* and *Raphanus Raphanistrum* are found on soils of acidity varying between pH 5.8-7.5 The presence of *Centaurea Cyanus, Dianthus Armeria* and *Achillea Millefolium* has been noted only on slightly acid soils (pH = 6.3).

On the other hand, weeds such as *Galium Aparine, Taraxacum officinale* and *Tussilago Farfara* have been met with only on neutral or alkaline soils.

The writers consider that the last two plants are indicators of neutral or alkaline reaction of the soil.

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General Notice.

E. Ramann †. On 19 January 1926 there died at Munich at the age of 75 the Nestor of Soil Science, E. RAMANN, a life of great usefulness being brought to an end by a sudden heart failure.

EMIL RAMANN was born on 30 April 1851 in Dorotheenthal near Erfurt, being the seventh child of his parents. His father was greatly interested in natural sciences and until the boy went to the Higher School his instruction was carried on by the parents, the mother being a Hamburg lady of great cultivation of mind. After the father's death, his unfinished work on butterflies was prepared for publication by the young RAMANN. He himself took up pharmacy and devoted himself to chemical studies in the Hamburg State Laboratory. Subsequently he studied chemistry and science at the University of Berlin; in 1881 he graduated at the University of Rostock, his dissertation being entitled: "Untersuchungen über die Passivität des Eisens", while in the previous year he had received his first appointment as assistant at the Eberswalde School of Forestry.

In 1880 he was given charge of the chemico-physical practical course. In 1885 he took rank as a lecturer, while in 1886 he became director of a

department of the Prussian Forestry Experiment Station and in 1890 professor.

In the year 1900 he was appointed at the University of Munich as the successor of EBERMAYER in the chair of Soil Science and Agricultural Chemistry, which he filled up to 1 December 1925. He was at the same time Director of the Soil Science Institute of the Bavarian Forestry Experiment Station and was also honorary president of the Soil Science Research Institute which he had organised with funds raised in Germany and from other countries.

On the occasion of RAMANN's seventieth birthday a communication by E. A. MITSCHERLICH relating to his life and work appeared in this Review,.

A vivid recollection of RAMANN's impressive figure will be retained by many of those present at the last Soil Science Congresses Widely known and honoured as pioneer in the domain of Soil Science, RAMANN took a keen interest in those institutes which came into being after the war. and their unqualified success afforded him special satisfaction in the last years of his life. He was fully convinced that in soil science the advance of scientific knowledge is only possible if there is close collaboration between all countries of the most various climatic and soil zones It was partly due to RAMANN that after the war scientific intercourse was so speedily and generally renewed, both in correspondence and personally. This was especially noticeable in his championship of his Russian fellow congressionists

The writer, who was one of RAMANN's students and an assistant of many years standing, feels that in responding to the invitation to contribute this account of him he should begin with RAMANN's life work for the development of general soil science, known as it was to all his fellow workers in the subject. The stages through which the science has passed and its present situation are fully expounded in the three editions of his basic work on soil science. Not so well known may be his essays which deal with his more restricted sphere of work as Professor of Forest Soil Science.

Mention should also be made of the experimental work planned on far-sighted lines which RAMANN during the last years of his life was able to undertake at the Soil Science Research Station with a view to the elucidation of certain fundamental problems. He accomplished this work up to a certain point but was not able to see the publication of the results

RAMANN's world wide reputation was made by his book on Soil Science, which first appeared in 1893 under the title of " Forstliche Bodenkunde und Standortslehre ". With the second edition in 1905 his interest had been transferred rather to the general sphere of Soil Science and he set before himself the aim of bringing together all that was previously known of the soil, and grouping the material along well defined lines.

Where he observed gaps, he made his own investigations and imparted a stimulus to others. Dr. J. HISSINK says of him : " RAMANN saw problems and knew how to attack them successfully ".

When to his sure scientific sense it was clear that gaps could not be filled from existing knowledge, he used to bridge the subject in a provisional way, thanks to remarkable synthetic powers. For this he could rely upon his experience of many years, work on the soil in its pristine condition and

PLATE XI.

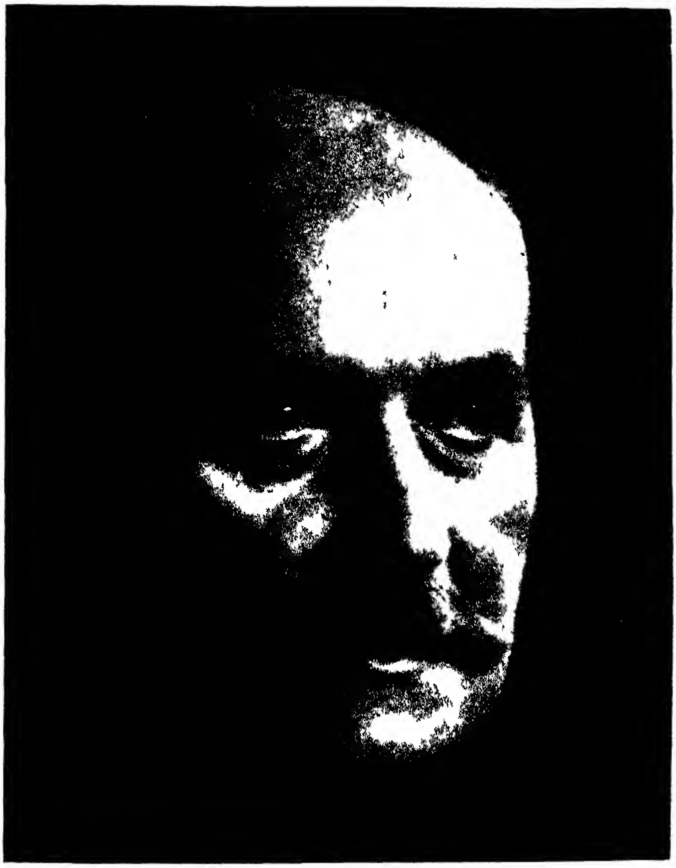

FIG. 52. — RAMANN. Born 30 April 1851 at Dorotheenthal near Erfurt, died at Munich 19 January 1926.

upon the lively intuition which he had acquired through his keen observation and acutely critical intelligence in the course of yearly journeys taken to all parts of the continent of Europe.

In this way from a number of single observations, even though gaps occurred, causal connections of the processes of soil-formation and transformation could be worked out, and by taking into account the results gained by other research workers it became possible to develop a consistent conception of natural processes in the soil and to state fundamental principles.

Hence a beginning was made of a systematic construction of the whole subject, and the recently developed branch, soil science, now became a science in itself, independent of geology and agricultural chemistry (E. A. MITSCHERLICH)

During the twenty years at the Academy of Forestry, RAMANN made the study of the soil in its pristine condition the main point of his experimental work. As is well known, in civilised countries such soil is practically only to be found in forests.

At the University of Munich he devoted himself, so far as opportunity allowed, to the work of applying the advances in general scientific knowledge, especially in physical and colloid chemistry, to the problems of soil science. This new direction of his studies is very clearly reflected in the third edition of his Soil Science, published in 1911, though much that appears there had to remain in the form of provisional statements, and soon became out of date owing to the rapid progress made by science in general

Although for a long time this third edition was out of print, and after the war was reprinted only in unrevised form, RAMANN could not decide to bring out the new work, which was generally looked for, without first making a comprehensive study of the present situation of the general theory of soil science Unfortunately, fate did not allow him the opportunity of carrying out this project. In the first place, the isolation of the scientist, during and after the war, had prevented all study of foreign scientific works, and when the literature of the subject was again available as a whole, RAMANN's interest and energy were fully occupied by the Soil Science Research Station which he had founded in 1910

He was very anxious to be relieved of his work of teaching, but this could only be arranged on condition that he relinquished all part in the direction of the Institute. His sudden death, a few months after his resignation of his professorship, is the more regrettable on account of the non-completion of his book, RAMANN having been a master of the general theory of Soil Science with all its border territories, whereas his younger colleagues are more or less compelled to specialise.

The articles contributed by RAMANN on the various branches of soil science, and forest chemistry are about one hundred in number, published in various reviews. The following is an account of some of the most important of these.

He began with researches on the circulation of mineral substances of the forest trees indigenous to Germany. By means of numerous ash-analyses further light was gained as to the extent of the utilisation, by the different types of timber, of the nutritive material in the soil, and at the same time

important knowledge was acquired as to the withdrawal of these substances from the forest, as the result of timber and firewood requirements and removal of litter. These studies are to be found throughout the *Zeitschrift für Forst- und Jagdwesen*. In the *Jahrbücher der Preussischen geolog. Landesanstalt* for 1884 and 1885 there are inserted articles on weathering of diluvial sands and on the formation of mother rock

Next follow investigations of soil in the pristine state, as for example, into the circulation of water in different forest soils.

In 1887 RAMANN wrote the section 'Forstliche Standortslehre' in LOREY's handbook on the science of forestry.

He then made a detailed study of the cover or litter transformation and humus formation in the forest, in particular the question of raw humus; the work of RAMANN, taken in conjunction with that of others, P. E. MÜLLER, etc., effecting a radical change in the views originally prevailing in Germany on these subjects. RAMANN also gave attention in this connection to the subject of moor formation.

RAMANN was among the first to examine thoroughly the reciprocal action between the soil and the natural plant cover.

In 1901 he brought out a treatise on European soil zones. Then followed proposals for classification and nomenclature of the humus materials and further essays on moors and slime deposits

In 1910 his first essay on colloid chemistry was published, and in 1911 an investigation of the life history of the small animals in the German forest soils.

Some years before a new cycle of work was instituted by RAMANN and his school relating to the absorption of the mineral substances from the soil by forest plants, special attention being paid to the annual intake of nutritive material and to the consequent "body building" as well as to the restoration of this nutritive material to the soil by the autumnal fall of leaves. This was followed by chemical investigations for the study of soil solution.

In 1918 a small volume appeared: "Bodenbildung und Bodeneinteilung" (soil classification), a short treatise on climatic types of soils from the standpoint of economic geography and the history of civilisation.

During his last years of life, articles appeared on the importance of carbon dioxide and hydrolysis in weathering, on the buffer action of bicarbonates in the soil, and a longer discussion on "Umsetzungen in heterogenen Systemen" (Influencie of Solubility) as well as essays on the importance of lime in the soil and several articles on questions of acidity.

In the article on the buffer action of the bicarbonates RAMANN emphasises very strongly, on the basis of some unpublished results of experimental work and their physico-chemical value, the conception of the harmful weathering or disaggregation' (*die schädliche Verwitterung*) which is caused by *pure* solutions of carbon dioxide. This *schädliche Verwitterung* is counteracted by the bi-carbonates. The recognition of this fact throws light on the important part played by calcium carbonate in the soil.

Among the work published in part only are RAMANN's articles representing several years' work on permutite, an artificial water-containing clay sili-

cate, which, as a 'model' substance to some extent chemically defined, was used, instead of natural clays, by various investigators for quantitative examinations into soil chemical transformations. In close connection with some published work on exchange of bases, there are in existence some still unpublished experimental researches into permutite debasification (removal of the bases in permutite) as the result of the action of carbon dioxide, and on the relation of this process to the various forms of acidity. (E RAMANN and H. JUNG).

A comprehensive work on the dispersoid physical and chemical conditions of the exchange of bases in permutite (E RAMANN and J. DANZL) is also unpublished

Collected articles by RAMANN on quartz suspensions will appear in the *Kolloidchemische Beihefte* for 1926 They cover more than ten years of separate research on chemically cleaned quartz powders of known granular composition and surface development. These cleaned and sedimented quartz particles have proved an experiment medium, sufficiently indifferent chemically and physically as a dispersoid, valuable both for the study of electric charge and discharge phenomena (by electrolysis, in particular below the threshold value of flocculation) as well as for adsorption investigations. By the introduction of these quartz powders, RAMANN made possible exact colloidal chemical researches into natural soil processes, reduced to the most simple case, and under forms admitting of calculation and of microscopic observation.

RAMANN laid great store by these studies on quartz suspensions and it was a very real satisfaction to him that he was able in the last few months of his life, thanks to the devoted work of his colleague, H. SALLINGER, to see the experiments completed and the work at least to some extent collated.

Although the non-completion of the fourth edition of the Bodenkunde is greatly to be regretted, full concurrence may be expressed with what was said of RAMANN by the representative of the University of Munich at the cremation :

" He attained all the objects which he placed before himself in his profession ".

As marks of professional recognition may be mentioned his appointment as member of the

Russian Academy of Sciences,
L'Académie d'Agriculture de Suède,
Scientific Forestry Societies of Finland,
Hungarian Academy of Sciences

and as

Honorary President of the International Soil Science Congress 1922 and 1924.

The Higher School of Forestry where he passed the first part of his scientific career appointed him in 1923 to a honorary doctorate in Forestry —

" as founder and first teacher of modern soil science and establisher of the scientific regional study of forestry " (*Standortslehre*).

G. KRAUSS,
Tharandt -Dresden.

The International Society of Soil Science. — *Session of the General Committee of the International Society of Soil Science.* Groningen, 10 a. m. 7 April 1926. Commissiezaal, Harmonie.

Present :

Prof. Dr. K. GLINKA, Honorary member.
Dr. Jacob LIPMAN, President.
Dr. D. J. HISSINK, Acting President and General Secretary.
Prof. Dr. F. SCHUCHT, Editor of the Review.
Dr. NOVÁK, Chairman of the First Commission.
Prof. Dr. Alexius A. J. VON' SIGMOND, Chairman of the Second Commission.
Prof. Dr. Eilh. Alfr. MITSCHERLICH, Chairman of the Fourth Commission.
Dr. H. R. CHRISTENSEN, Representative of Denmark.
Dr. Sl. MIKLASZEWSKI, Representative of Poland.
H. J. PAGE, Representative of England.
Prof. J. HENDRICK, Representative of Scotland.
Dr. B. A. KEEN, Representative of the British Colonies.
Dr. K. ZYLSTRA, Auditor

and as guest : Prof. Dr. N. M. COMBER from Leeds.

Prof. Dr. O. LEMMERMANN (Germany) and J. J. GIRSBERGER (Switzerland) were unable to attend. Dr. BORGHESANI, librarian, arrived the following day.

ORGANISATION OF THE SOCIETY.

Statement of Accounts.

		Fl.
Received up till 1 January 1926 :		
363 Foundation members (1924)		1897.77
283 entrance fees 1925	fl. 714.33	
589 members subscriptions' 1925	» 3825.04	
		4539.37
Contribution of the Czechoslovakian Government.		72.75
Received for the Reports of the Fourth Conference (Rome 1924) .		209.20
		6719.09
Outstanding for 1925 :		
24 entrance fees at fl. 2.50 = ...	fl. 60.00	
77 yearly subscriptions (part payments) . . .	» 477.53	
		537.53
		7256.62

Expenses up to 1 January 1926:

Expenses of the International Committee of Soil Science from April 1922-May 1924 (Prague, Zurich, Rome)			325.00	
Commission FROSTERUS-WIEGNER-GESSNER . . .			25.49	
				350.49
Expenses Groningen 1924:				
Printing	fl.	53.50		
Correspondence	»	66.65		
Secretarial expenses	»	120.00		
Cost of translations	»	80.00		
			fl. 320.25	
International Reports on Pedology			» 713.18	
				1033.43
Expenses Groningen 1925:				
Printing, paper, etc			fl. 128.74	
Archives etc			» 215.00	
Correspondence			» 205.35	
Secretarial expenses			» 384.50	
Cost of translations			» 138.00	
Contribution journey Berlin			» 42.50	
				1114.09
Editorial Office Berlin				474.26
Commission WOLFF, MITSCHERLICH, NOVAK, von 'SIGMOND . .				244.41
Contributions sent to Rome for the reports of the Fourth Conference (Rome 1924)				222.61
International Institute of Agriculture 691 Members' subscriptions fl. 2.00			fl. 1382.00	
Reprints, Statutes, Circulars, etc.			» 116.00	
				1498.00
				4937.29
Due Commission STOKLASA and GIRSBERGER				100.00
				5037.29
Balance to 1 January 1926.			fl. 6719.09	
			» 5037.29	
			» 1681.80	
Outstanding Debts 1925			» 537.63	
			» 2219.33	

The auditor, Dr. ZYLSTRA, passed the accounts as in good order with full discharge of the General Secretary.

The General Secretary made the following statement of the expenses per member :

1. Charges for collection of subscriptions			0.50
2. Review expenses			
(*a*) Institute Rome	fl.	2.00	
(*b*) Editorial Office Berlin	»	1.00	3.00
3. Expenses in connection with secretaryship, Groningen .			2.00
4. Expenses in connection with Commissions			0.50
5. Not recoverable etc			0.50
yearly contribution per member			6.50

The General Secretary stated that collection of subscriptions, registration of new members and changes of addresses entailed too much work. It was decided decided to form in the separate countries national sections, which will be responsible for this part of the work. For the following countries the following addresses can be given :

Germany : Prof. Dr. Schucht. Güntzelstrasse 59. *Berlin-Wilmersdorf.*

Denmark : Dr. H. R. Cristensen. Planteavls-Laboratorium. *Lyngby.*

Spain : Sr. D. Emilio H. del Villar, Lista 62, 3° der. *Madrid.*

United States of America : Prof Dr. Jacob Lipman, Experiment Station. *New-Brunswick,* New Jersey.

England and Dominions : Dr. B. A. Keen, Rothamsted Experimental Station. *Harpenden,* Herts.

Hungary : Prof. Dr. A. von 'Sigmond, Technische Hochschule. *Budapest I,* Szent-Gellerter 4.

Italy : Dr. G. A. R. Borghesani, International Institute of Agriculture. Villa Umberto I. *Rome* (10).

Norway : Doc. Johs Lindeman. Landwirtschaftliche Hochschule. *As.*

Dutch-Indies : Dr. Bernard. Algemeen Proefstation voor Thee. *Buitenzorg.* Java.

Poland : Dr. Slaw. Miklaszewski. Rue Szopena 6. *Warsaw.*

Russia : Prof. A A. Jariloff, Wosdwyenka, 5 Gosplan. *Moscow.*

Czechoslovakia : Dr. V. Novák, Chef de l'Institut Pédologique, Kvetna 19. *Brno.*

Letters received :	1924 —	233
	1925 —	1006
Letters sent :	1924 —	258
	1925 —	533

The General Secretary proposes that the costs of sending out Part A of the Proceedings of the Second Commission (amounting to fl. 258.88) shall be paid by the International Society of Soil Science. Approved.

A telegram from the International Institute of Agriculture in Rome was received, requesting that a representative be appointed to attend the General Assembly of the Institute, to be held from 19-26 April in Rome. Dr. Lipman was chosen.

Review. The editor, Prof. Dr. F. SCHUCHT, stated that up to the present he had not been able to give collective reviews of the soil science publications in the separate countries. The reviews have, for the time being, been grouped under the headings of physics, chemistry, etc. The editor added that the numbers have been late in appearance while comments have been made as to the technical and linguistic mistakes occurring in the translations. After a long discussion, the President of the Society is commissioned to talk over the matter with the President of the International Institute of Agriculture in Rome. The following resolutions as regarding the Review are passed :

1. To express our thanks to the President of the International Institute of Agriculture in Rome for having the Review printed and published on such advantageous terms for the Society.

2. To ask that the revision and translations of the Review be executed with the utmost care.

The technical revision of the translations of the original texts can only be satisfactorily undertaken by soil scientists of the country, where the language of the translation is spoken.

It is advisable that the first proof in each language be sent to a soil scientist, who would act as sub editor. This latter should be chosen in consultation with Prof. SCHUCHT, for France, England and Spain. For the Italian and German texts Dr. BORGHESANI and Prof SCHUCHT will take the responsibility.

3. The Committee learns with pleasure that the Review will appear more regularly in the future.

At the end of the discussions a vote of thanks was tendered to the editor of the Review.

THE FIRST CONGRESS OF SOIL SCIENCE, U. S. A. 1927.

The President, Dr. LIPMAN, made the following statement :

(1) Several societies in America have offered their moral support to the Congress.

(2) The President of the United States, Calvin COOLIDGE, will send a message to Congress giving his consent to the invitation of the delegates of the different countries.

(3) Accordingly, the American Organising Committee will recommend to the Governments to appoint as delegates certain soil scientists, and to nominate the members of the Executive Committee and of the General Committee, as well as the members of the Committees of the different international Commissions.

(4) An endeavour is being made to collect 60.000 dollars, to be employed as follows :

(*a*) $5000 for the Secretariat ;

(*b*) $5000 for the Congress proceedings ;

(*c*) $5000 for the Exhibition ;

(*d*) $45.000 for the expenses of 150 official members taking part in the excursions to be arranged after the Congress ($300 per person).

(5) An endeavour is being made to obtain hotel accommodation in Washington at reduced tariffs.

(6) Committees have been formed in the various States to collect funds for the Congress.

The President, Dr. Lipman, gave the following outline of the prolonged excursion to be arranged after the Congress:

It is intended to make an excursion from Washington to California, which will last about 4 weeks and which will be cost free for those members who are not resident in the United States of America.

The minimum cost of the Congress will be about:

Europe-NewYork and back	$250.00
New York-Washington and back	$ 20.00
Hotel expenses Washington	$ 40.00
Extra expenses	$ 90.00
	$400.00

It seems advisable to publish this estimate of the cost as soon as possible and to mention it in the letters of invitation.

It should be noted that the excursion is only gratis for those members who are soil scientists, and not for ordinary members of the Congress. The American Organising Committee will discuss this point with the General-Secretary.

Members of the International Society of Soil Science will not pay any extra contribution to the Congress.

Date of the Congress. The A. O. C. (American Organising Committee) intends to hold the Congress in Washington in June 1927. Some countries proposed September, others June. Dr. Lipman will inform the A. O. C.

Programme of the Congress.

It was decided to recommend to the A. O. C. the following arrangements:

(*a*) Three days for the meetings of the Commissions;
(*b*) Two days for the Plenary meetings;
(*c*) One day for the final session (passing of the resolutions);
(*d*) One day of rest.
(*e*) One day for short excursions.
(*f*) One day for the Exhibition;
(*g*) If possible one day for the discussion of the Russian reports.

Programme of the Commissions.

First Commission. The Novák Commission proposes to meet in 1926 in order to draw up the programme.

Second Commission. (von 'Sigmond Commission). The programme of this Commission will appear in part B of the Groningen Proceedings.

Third Commission. The Stoklasa Commission intends to meet in Berlin in June 1926

Dr. Waksman has drawn up a provisional programme of the questions to be discussed by this Commission: 1. Direct methods of microbiological examination of the soil. 2. Cultural methods of the microbiological examination of

the soil. 3. Soil population. 4. Fixation of nitrogen in the soil. 5. Transformation of nitrogen in the soil. 6. Transformation of the organic substance in the soil. 7. Transformation of the mineral elements in the soil. 8. Soil Biology, seen from an agronomic standpoint.

Fourth Commission. The President of the Fourth Commission, Prof. MITSCHERLICH, and the Vice-President, Dr. ZYLSTRA suggest the following programme :

1. Determination of the materials of plant nutrition in the soil.(physiological methods).

2. Influence of the reaction of the soil on plant yields.

3. Plant stimulants and plant poisons in the soil.

Fifth Commission. The provisional programme of subjects for discussion is given in an appendix (see below).

Sixth Commission. No announcement is yet made as regards the Girsberger Commission.

Finally, the programme of the Bureau of the delegates of the Russian soil scientists was announced by Prof. GLINKA, who asked that one day of the Congress might be devoted to the discussion of the following programme:

1. Historical summary of the development of soil science in Russia ; 2. Soil morphology ; 3. Classification and scientific grouping of the soils ; 4. Physical and chemical properties of soils ; 5. Humus of the soils ; 6. Soil Mapping ; 7. The dynamics of soils , 8. The genesis of soils; 9. The post-tertiary deposits and soils , 10. Application of soil science to agronomy, to land surveys, to division into soil regions, to land settlement and improvement.

Further, that an exhibition should be organised as follows to show the soil types of the U. S S. R

1. Monolytes of the principal types and varieties of the U.S.S.R. in several zones , 2. Collected samples of the soil profiles ; 3. Collection of the morphological characteristics of the soils ; 4. Soil maps and plans of different regions in Russia ; 5. Literature ; 6. Drawings and sketches of apparatus invented by Russian soil scientists.

Finally it was unanimously decided to propose to the Congress in Washington that the second Congress should be held in Russia. If it proves impossible for the Congress to be held in the latter country, the votes of the General Committee will decide between Germany and Poland.

Dr. D. J. HISSINK,
General Secretary.

Appendix. Provisional programme of the Fifth Commission for classification, nomenclature and mapping of soils, by Prof. MARBUT, Washington.

I. *Classification of soils.*

1. The extent to which the geology of the archaic rocks is to be used as a basis for the division of the soils into units or groups of units. 2. The extent to

which the climate of a region and its natural vegetation can be used as a basis for the division of soils into units or groups of units. 3. The extent to which the situation or other geographical circumstances form a basis for the division of the soils into units or groups of units 4. What significance should be attached respectively to field observations and laboratory characteristics of soils in the statement and definition of the different categories in a comprehensive scheme of soil classification. 5. The extent to which the quantity and nature of the organic soil substance can be used as a basis for the division of soils into units or groups of units. 6. Should the different categories in a scheme of soil classification be founded on soil characteristics or on the forces and conditions under which the soils are formed? 7. General review of the soil in the narrower sense (*solum*) and its profile forming parts. Discussion of the term "soil", changes in its appearance, according to the development of the profiles. Description of different profiles in the soils of the world, relative importance of the appearance, conclusions from the various descriptions of sections and maps exhibited. 8. Submission of proposed schemes of soil classification on the basis of the appearance of soil profiles. 9. Conclusions and Recommendations.

II. *Soil Nomenclature.*

1. Soil nomenclature in the United States of America. 2. Soil nomenclature in Canada. 3. Soil nomenclature in Mexico. 4 Soil nomenclature in the South American countries. 5. The extent to which the present soil nomenclature can be used in designating the different categories in a comprehensive scheme of soil nomenclature 6. The extent to which a uniform international soil nomenclature is possible. 7. Statement and discussion of proposed systems of soil nomenclature by members of the Commissions 8 Soil colours and their nomenclature.

III. *Soil Mapping.*

1. Proposal of a uniform colour scheme for the soil survey maps of all countries. 2. Discussion and final establishment of those geographical and general soil conditions, which are to be marked, besides the soils, on the special and the survey maps. 3. The degree of specification to be attempted for the soil survey maps.

Meeting of the First International Commission at Rothamsted. — To the Members of the International Society of Soil Science. With reference to the circular, we have the honour to inform you that the meeting of the First International Commission will be held at Rothamsted in the month of October.

The very important question of International Methodology will be discussed and the resolutions to be submitted to the First International Congress at Washington will be prepared.

Members intending to take part in the Rothamsted meeting are requested to communicate with the Chairman of the Commission Dr. V. NOVÁK (Brno, Kvetna 19, Czechoslovakia) up to the end of June.

The definitive programme of the Rothamsted meeting will be sent later on to those members only who have signified their intention of being present.

Yours faithfully.

Brno, May 4th 1926

Dr. Ladislav SMOLÍK,
Secretary of the
First International Commission

Dr. Václav NOVÁK,
Chairman of the
First International Commission

International Society of Soil Science (Pedology). Subscriptions. — The annual subscription for 1926 has been fixed at *f* 6.50 (Dutch guilders) New members pay an entrance fee of *f* 2.50, i. e., a total of *f* 9.— (Dutch guilders).

Members are requested to forward to me before 1 May, 1926, the sum of *f* 6.50 — or *f* 9.00 for new members — being the subscription for 1926.

There are still a great many members who have not yet paid the annual subscription for 1925 (f 6.60 or f 9 00 guilders, as the case may be), although three separate circulars have been sent to them, calling attention to this point. These members are urgently requested to forward the money for 1925 by return.

In countries where National Sections have been formed, it will be best for the annual subscription and entrance fee to be collected by these Sections.

Members receive the Proceedings and other publications of the Society gratis.

New members who desire to receive Volume I (1925) of the Proceedings, should apply to Dr. G. A. R. BORGHESANI, International Institute of Agriculture, Villa Umberto I, Rome (10).

New members are requested to send me their exact address, typewritten, and to inform me at the same time in what language (French, English German, Italian or Spanish) they desire to receive the Proceedings.

Finally I should be glad if members would work for the formation of National Sections and report to me on the composition of the executive committees.

Groningen, February 1926

Dr. D. J. HISSINK,
Acting Chairman and General Secretary,
Groningen (Holland), Herman Colleniusstraat, N° 25.

Requests to members.

(1) to form National Sections,

(2) to pay their subscriptions through these Sections or, where such Sections do not exist, to me,

(3) to pay their subscriptions for 1926 by 1 August at the very latest;

(4) with regard to joining the various Commissions, to communicate with the respective Presidents;

(5) to communicate with Dr. BORGHESANI in the event of having any complaints to make as regards the forwarding of the Proceedings.

Groningen, February 1926.

Dr. D. J. HISSINK,
Acting Chairman and General-Secretary,
Groningen (Holland), Herman Colleniusstraat, Nr. 25.

Archives of the Society. — With the object of finally arranging the Archives of the Society under the following Sections :—

1. Publications ;
2. Documents ;
3. Maps ;
4. Photographs, drawings, and similar material ;
5. Schedules, forms, etc.,

the Members of the International Society of Soil Science are asked to send direct to the undersigned, all material already available, lately published or still unpublished, relating to Soil Science, whether their own personal work, or otherwise

The Service of the Archives of the Society will then prepare the slips relating to such material for the card index.

This Service can also supply all bibliographical information, copies of documents and printed matter at cost price.

Dr. G. A. R. Borghesani,
Librarian of the Soil Society,
Scientific Service of the International
Institute of Agriculture
Villa Umberto I., Rome.

Reconstruction of the Library of the " Laboratoire d'Agronomie Coloniale " (Paris).

Professor Auguste Chevalier, Director of the " Laboratoire d'Agronomie Coloniale " makes an urgent appeal to the Members of the International Society of Soil Science to help him to reconstruct the library of the laboratory which was destroyed by a fire last June. The library consisted of more than 20.000 treatises and manuscripts collected during a period of 30 years.

PROCEEDINGS OF THE INTERNATIONAL ASSOCIATION OF POULTRY INSTRUCTORS AND INVESTIGATORS

Abstracts.

New Experiment on the Influence on Growth of the B Vitamin and its Quantitative Demonstration.

ABELS H *Klinische Wochenschrift*, 2nd. July 1925.

It has been shown that animal tissue, in respect of cell absorption and assimilating power, depends in the greatest measure on the presence of vitamins, and particularly the B vitamin, so that a lack of this vitamin causes great deterioration in these essential functions of the tissue.

A new experiment of ABEL shows the great detriment to another tissue function, also dependent on assimilating power, namely regeneration, or the regenerative growth.

Two pigeons were first fed for a week with polished rice and water, the feathers were then plucked out of a part of the left side of the breast, and from then both pigeons were given one gramme of dry yeast. With one pigeon the yeast was previously heated to 130° C. for 5 hours, and thereby the B vitamin destroyed. The re-growth of the feathers with the pigeon provided with the B vitamin was very luxuriant; with the pigeon without vitamin there was no re-growth.

It is possible that this method will also be useful for further differentiations of the B vitamin, which probably represents a group- of substances. B J. C. te H.

Spreading Poultry Tuberculosis in Domestic Fowls.

ARNOLD ALWIN. *Zeitschrift fur Fleisch- u. Milchhygiene*, Fasc. 5, p. 71. Oschatz, 1924.

As is known, the skin of our domestic animals, together with the muscles, is not very liable to tuberculous disease. Tuberculosis has been observed in parrots, on the head, in the form of horn-like tubercles, but the hen is not mentioned in the manuals.

ARNOLD now describes skin tuberculosis in a hen of a master butcher, who fed his poultry with tuberculous parts of the meat, and thus infected the whole run. The skin showed, for the most part, specially prominent on the back and the breast, callous elevations the size of a pfennig piece, 3-10 mm. thick, partly flat, partly knotty. This compact, fibrous growth of the cuticle, which contained isolated cheese maggots, some ray-like, some round-oval, radiated into the muscles and joints.

Tuberculous ulcers were also visible. Tubercle bacilli were indicated. It is a case of regional, fibrous skin tuberculosis, set up by infection through sores. B. J. C. te H.

On the Relations between the Rhythm of Respiration and the Rhythm of the Heart in Birds.

ARTOM, CAMILLO. *Archives Néerlandaises de Physiologie de l'homme et des animaux*. Vol. X, 3rd. Fasc. p. 362. The Hague, 1925.

An investigation of the relations between the rhythm of respiration and the heart rhythm in the case of those birds whose search for food is conditioned by frequent and prolonged diving.

It has been generally known for a considerable time that there is lengthy and complete inhibition of the respiratory movements in these birds every time the head, or even the beak only, is plunged into water, and that this occurs even if it is made possible for them to breathe freely by means of the insertion of a tube communicating with the air. Generally the inhibition remains complete during the whole time that the head of the bird remains under water. This period may be very long, and in any case much longer than would be enough to kill by asphyxia animals of approximately equal weight but with different habits of life.

ARTOM has made many experiments with ducks and other birds (*a*) with the vagus nerve intact, (*b*) after double vagatomy and in the following conditions :

1) Normal conditions.
2) Extension or dorsal flexion of the neck.
3) Submersion of the head.
4) Submersion of the head and continuous supply of pure air, these two artifices being practised conjointly.

Conclusion :— The relations between the rhythm of respiration and the rhythm of the heart seem capable of satisfactory explanation by the hypothesis of the action of CO_2 of the blood on the cardiac inhibitory centres ; with more considerable doses of this gas, direct action on the muscle of the heart probably occurs secondarily. The mechanism of these relations between the heart and respiration is probably identical in diving and non-diving birds ; however fairly marked differences, but bearing almost exclusively on respiratory inhibition, exist between these two groups of very closely allied zoological species endowed with different habits of life.

At the end of his very interesting paper ARTOM gives 23 references to literature on this subject. B. J. C. te H.

The Effect of Feeding *Bacillus acidophilus*, Lactose, Dry Skim Milk or Whole Milk on the Hydrogen Ion Concentration of the Contents of the Caecum of Chickens.

BEACH J. R. *Hilgardia, a Journal of Agricultural Science*, p. 146. Berkeley, California, October 1925.

These experiments were undertaken to determine in what matter, if any, the hydrogen ion concentration of the caecal contents of chicks

would be influenced by feeding them with milk or certain milk products and the relation of any changes found to occur to the control of coccidiosis.

The studies have been confined to the caecum because coccidial infection of chicks is usually confined to this part of the intestinal tract.

The pH of the caecal contents of chickens was changed from the normal range of 6.0 to 7.4 to a range of 4.4 to 5.6 by feeding sufficient amounts of whole sweet milk, milk cultures of B. *acidophilus*, milk cultures of B. *acidophilus* plus lactose, lactose alone or dry skim milk.

The change in the hydrogen ion concentration of caecal contents from a single feeding of a milk product occurred within two hours to two hours and a half after the feeding and returned to normal within 8 to 24 hours after the feeding. B. J. C te H.

The Influence of Feeding Lactose or Dry Skim Milk on Artificial Infection of Chicks with *Eimeria avium*.

BEACH J R and DAVIS D E *Hilgardia, a Journal of Agricultural Science*, p. 167, Berkeley, California, October 1925.

In these experiments it was attempted to combat artificially-produced coccidial infection in chicks by feeding them with sufficient lactose or dry skim milk to change the hydrogen ion concentration of the caecum from the normal range of 6,0 - 7 4 to a range of 4.4 5.6.

The results were uniform in demonstrating that a considerable degree of a protection against coccidial infection was gained when a sufficient amount of lactose or dry skim milk was added to the diet of chickens.

B. J. C te H

A New Tape-Worm of the Hen, *Raillietina (Davainea) grobbeni* n. sp.

BOHM L K (Vienna) *Zeitschrift fur wissensch Zoologie*, Vol. 125, p. 519. Leipzig, 1925.

In the small intestine of a hen, which it had penetrated for some unknown reason, were found 10 chains (with their heads) and broken pieces of an 11th. chain of a tape-worm of the species *Davainea*. Further, by microscopical examination of the intestine, peculiar, nearly conical bodies were found of about ¼ mm. diameter, which on closer examination appeared as eggshell like forms. As no account has yet appeared of such forms in connection with tape-worms, BOHM proceeds to describe them. With this object, he first attempted their classification, and found it had to be a case of a new species.

As a result of the extraordinary thickness of the cuticle with this species and of the strongly developed muscular system along the parenchyma the preparations *in toto* — even with careful squeezing — only gave an unsatisfactory view of the internal organisation of the proglottis. BÖHM therefore made use of a method which consists in first with the aid of the microtome, removing one cuticle (dorsal or central) of the pro-

glottis which was stained previously to embedding and then cutting away the other cuticle. These preparations combine the advantages of the preparations *in toto* and of the fine sections. BÖHM calls them " Halbtotopräparate ". He describes the external marks and anatomy of the work quite exactly, and gives very clear drawings.

Conclusion : On the basis of the relations of the cirrus vessel and the egg capsules, the worm is to be classed in the branch species *Raillietina* of the species *Davainea* Blanch, rich in varieties, established by FUHRMANN (1920), within that of the sub-species *Ransomia*, also established by FUHRMANN (1920).

He chose the specific name (*grobbeni*) in honour of his teacher, Prof. Dr. K. GROBBEN of Vienna. B. J. C. te H.

Artificial Lighting of Poultry Houses.

BROWN E. T. *Journal of Ministry of Agriculture*. p. 716. London, November, 1925.

The object of lighting is to increase the rate of production at a time of year when the retail price of eggs is high. The results fully justify the initial expense of installing lights in the sheds and the slight extra amount of labour entailed in attending to the birds after dark.

M. BROWN comes to the following conclusions :

(1) The effect of lighting the house is to increase the output of eggs during the winter, as the average number of eggs laid by the test flock during the first 12 weeks was 61 ¼, as against 34 ¾ laid by the control flock.

(2) The annual production is only slightly increased, in this case by 12 ¼ eggs per bird.

(3) The cost of the additional food amounted to 6 ¼ d. for the year, whereas the increase in egg value was 5 s., 1 ¾ d. per bird ; an increase in gross returns which is more than sufficient to pay for the extra cost of labour and lighting. B. J. C. te H.

Bacillary White Diarrhoea of Chicks.

DOYLE T. M. *Journal of Comparative Pathology and Therapeutics*. Vol. XXXVIII, part 4, p. 266. Edinburgh, 1925.

Bacillary white diarrhoea is essentially a disease of artificial incubation. It may also occur on farms where only natural methods of hatching are employed, but in such cases it rarely causes any trouble and tends to disappear.

This is partly due to the dark, warm atmosphere of the incubator being favourable for the survival of the causal parasite, while, under natural conditions, the light and temperature have an inhibitory effect and rapidly bring about its death.

As hen-hatched chicks also are continually on the move, the infection is disseminated over a wide area and the same conditions do not occur as in a crowded brooder house. The fowl is the only species susceptible to

natural infection. Many chicks which survive the disease harbour the parasite in one or moie of their organs throughout life.

Morphology, Cultural Characters, Pathogenicity etc. are described.

The gas-producing powers of *B. pullorum* are of a fluctuating character and there does not appear to be any reasonable grounds for distinguishing two groups, as has been suggested by HADLEY (1).

The agglutination test. A point of practical importance is that reacting birds always have infection of the ovaiy; other organs may also be infected. This conclusion is based on the results obtained from the bacteriological examination of a considerable number of reactors.

In America agglutination in a dilution of 1:33 is considered to signify infection, and in England in a dilution of 1:50. DOYLE, as the result of work, recently carried out, now regards complete agglutination in a dilution of 1:25 as a positive reaction.

DOYLE has tested the method of BEAUDETTE, but in no case has found any trace of agglutination with the albumen of eggs from carriers. The yolks of some of these eggs were proved to be infected with *B. pullorum*. The method th refore appears to be valueless.

It is known that the *B. pullorum* a d the *B. sanguinarium* cannot be differentiated by serological methods A positive reaction to the test will signify, therefore, infection by either of these organisms.

The organism is not a normal inhabitant of the healthy chick. The fact that many chicks which recover, harbour the causal agent and are the potential source of future outbreaks, is a strong argument against the policy of treatment.

B. J. C. te H.

Eye Nematode in Chickens.

HOK L. *Petaluma Poultry Journal*, No. 2. Ling Nan Agricultural Manufacturing Company, Petaluma, California, 1926.

The eyes of some pullets became badly swollen. Some died. In the opaque, whitish fluid around the eyeball were found small thread-like organisms. On microscopic examination it was found to be a member of the Nematoda, very likely *Filaria mansoni*, described by Sir Patrick MANSON in Hongkong.

The larvae of the *Filaria* grow to about 300 micrometers and live in the blood septem of the host. The adults are slender nematodes from one-tenth of an inch to a few inches in length. They can be transmitted from one host to another through the agency of the members of the Culicidae or the mosquitoes. The Chinese saying: " A mosquitobite causes the blindness of chickens " may have truth in it.

B. J. C. te H.

(1) As far as Holland is concerned I fully agree with HADLEY, as I have never seen a non gas-producing strain change into a gas-producing one. — B. J. C. te H

Poultry Farming and Egg Production in Denmark.

KOCK W A Publishers Dyva and Jeppesen Copenhagen, 1925.

The difficulties which beset Danish agriculture in the eighties of last century as a consequence of foreign competition and falling prices made many Danes anxious to find new sources of income. One of the most important of the subsidiary activities that were taken up was poultry keeping, with a view to egg production. Now, on many farms, poultry keeping constitutes one of the principal sources of income.

The introduction of Mediterranean breeds has had a great and beneficial influence on the numerical output of eggs in Denmark and also on the size of the eggs themselves. Together with Plymouth Rocks, Wyandottes and Rhode Island Reds introduced from America, the Mediterranean breeds of fowls are certainly among those most widely spread throughout Denmark. In 1888 the number of hens, cocks and chickens was 4.5 millions; in 1924, 21.3 millions. Little attention is paid to fattening, while systematic duck breeding is practically unknown in Denmark. There are only a few turkey breeders, but the breeding of geese is of some importance.

Eggs were exported to England by the regular steam route for the first time in 1865. In 1924 the egg export was third on the list of agricultural products, and amounted to 41.6 million score with a value of 150.8 million Kroner.

In 1895 the Danish Cooperative Egg Export Society was started The great advantage of this excellent organisation is that it has established the collection and stamping of eggs Each egg is stamped with a number indicating the producer, which makes it possible to immediately identify suppliers of eggs of inferior quality. The local branches of the society all have their own egg collecters, who make a tour of the members at regular intervals. All eggs are stamped with the trade mark of the Society. They are exported at once, the object of the Society being to furnish foreign markets with only the very best possible newlaid Danish eggs.

One of the most effective means towards development of poultry farming has proved to be the competitions for the best kept and most profitable stocks of fowl belonging to individual members, the aim being to promote poultry breeding on strictly economic lines, no regard being paid to the purely show aspect. From the breeding centres cheap eggs are also distributed for hatching.

The Danish Poultry Breeders Union extends over the whole country. It promotes poultry farming by holding poultry breeding courses, egg-laying competitions, poultry exhibitions; it establishes control stations, issues a monthly paper and gives advice to poultry farmers.

B. J. C. te H.

The Breeding Diseases of Poultry, and their Control, with Special Reference to Tuberculosis.

LERCHE M. *Deutsche tierarztliche Wochenschrift*, No. 48, p. 840. Breslau, 1925.

The aim of the German farming industry is to become gradually independent of imported supplies of eggs and table fowls. Poultry

breeding has on this account become of great importance in the post-war years.

Several diseases are described.

Diseases like dysentery the causes of which are various ; infections with *bact. coli.*

Within the paratyphus group are named :

1. *Bact. pullorum*, which serologically is near to the Piper poultry typhus, but bio-chemically is different from it.

2. *Bact. typhi gallinarum alcalifaciens* Pfeiler or *Bact. sanguinarium* Klein. As a rule it occurs in fully grown poultry. LERCHE, however, found it in 7 farms as a special disease of young fowls.

3. Paratyphus of water fowls, hitherto described as paratyphus B. Vaccine inoculation against these diseases has proved good. Sera must not be inserted with carbolic acid, because with quite young chickens poisoning has been observed. The State Serum Institute, Rotterdam, considers a special serum necessary. With these infections it is useful to substitute whey for the drinking water.

UHLHORN carried out a series of transmission tests on chickens with *Eimeria stidae* of rabbits, which gave surprising results. The chickens were infected, but only showed transitory symptoms of disease, and recovered again, whereas with poultry cultures, infected chickens died after 3-5 days.

The poultry brood suffers most from tuberculosis. All breeders should regularly have their fowls examined for tuberculosis by means of the intra-cutaneous tuberculosis test. The tuberculous reaction is 1-11 days after a positive injection, even though diseased processes cannot be microscopically recognised on the organs. A favourable influence can be effected by cold-blooded tubercle bacilli. Specially noticeable is the early revival of laying capacity. What this action depends on is not at all clear ; it does not appear to be a specific albuminous action. Warning must be given against indiscriminate inoculation with Friedmann inoculating matter without segregating the diseased, fowls since with this treatment only subjects immune to bacteria remain alive.

The Poison of Fowls and Vacccine Pock Marks.

VAN NEDERVEEN H. J. Volgelpok en Vaccinevirus. *Tydschrift voor Diergeneeskcende*, Vol. 53, p. 63. The Hague, 1926.

After the passage of fowl pock virus, emanating from a diseased hen through rabbits and calf, characteristic pock marks were produced on the arm of a child ; these pustules were quite similar to vaccine pock marks.

After these passages, the virus, together with those acquired, had fully maintained the original qualities : Introvenous incorporation of the modified virus in the susceptible hen always resulted in the disease of fowl pock (formation of diphtheritic mouth membrane).

On the basis of his experiments, the author concludes that there is an intimate relationship between the two viruses.

B J. C. te H.

Avian Tuberculosis in Mammals.

PLUM N. *Publication of the Serum Laboratory of the R. Veterinary and Agricultural High School Copenhagen.* Printed by Kundrup & Wunsch, 1925.

A very thorough study on the above problem, containing exhaustive bibliography. Pages 67-100 deal with previously described cases of spontaneous avian tuberculosis in mammals (human beings, horses, cattle, pigs, and various small animals). In summing up this section, PLUM says: Avian tuberculosis in pigs has been so minutely investigated, that its significance for this animal can be considered to be cleared up. The significance of this infliction for mankind will be greatly elucidated in a future not too remote. Systematic studies with regard to the horse have been made.

A defect is that in most experiments mammals only have been used and hardly ever hens at the same time.

Mammals are in general infected by ingestion of faeces containing bacilli, or by eating the carcases of fowls.

With man there is always the possibility that he can be infected by eating eggs containing bacilli, for it is proved that the eggs of tuberculous hens can contain bacilli, which are not killed by the usual light boiling. Pages 100-121 describe cases of experimental avian tuberculosis, namely, with porpoises, rabbits, dogs, monkeys, mice, rats, pigs, and various other animals.

The results may be summarised as follows:--

(1) Subcutaneously injected avian tubercle bacilli are only capable of producing local reactions.

(2) Intraperitoneally inoculated avian tubercle bacilli were capable of causing tuberculosis in certain animals, but not in others. With all animals, large doses of not very virulent material are, on account of the toxic action of the bacilli, capable of causing death accompanied by cachetic symptoms, with atrophy of the organs. With all animals death can be caused with symptoms of type Yersin.

(3) In young animals, avian tubercle bacilli of great virulence appear as a result of ingestion of feeds.

Pages 126-174 describe particular investigations of PLUM. The following remarks appear in the summary: —

Whilst formerly the possibility of avian tuberculosis in children was not taken into account it is now proved that children may be infected spontaneously with ornitho-tuberculosis. Comparatively many of those animals which react to avian tuberculosis have aborted. The pregnant uterus appears therefore to be a place sought eagerly by the ornitho-tubercle bacilli. Animals which abort on account of avian tuberculosis are either not attacked in any other place, or the demonstrable alterations, which take place preferably in the lymphatic glands of the alimentary canal, are very slight. When the avian tubercle bacilli have attacked the uterus, they are able to cause abortion. The bacilli subse uently maintain life in the abscesses which form under the

mucous membrane of the uterus, and so later abortion can again take place.

The only rational method for control of avian tuberculosis is to keep in view the source of infection itself, namely, the poultry. Hitherto avian tuberculosis has been allowed to gain ground amongst poultry, in a manner completely foreign to the general conditions of care of farm stock in Denmark.
B. J. C. te H.

Investigations concerning Para-typhus Germs of Vertigo in Carrier Pigeons.

RICHTER E. *Zeitschrift fur Veterinarkunde*, No 12, December 1925.

Giddiness or vertigo causes heavy losses in pigeon farms. Generally speaking, only pigeons of 4-10 weeks fall sick. Subdural abscesses are found in the large and small brain. Bacteriological culture treatment gave a bacterium of paratyphus group B in pure culture.

RICHTER describes the morphology, biology etc. of the bacterium. Various experiments were made with mice and pigeons, all the bacterial cultures showed themselves in food tests as mouse-pathogenic, and those taken are to be considered as specific pigeon cultivations.

In the summary RICHTER says:

" According to the results of the pigeon infection tests, these bacteria represnt only concomitants of the unknown stimulus causing vertigo or staggers ".
B. J. C. te H

General Information.

Request for co-operation in the Proceedings.— M. B. I. C. te HENNEPE editor of the Proceedings of the International Association of Poultry Instructors and Investigators, invites all who are interested from a scientific point of view in avicultural questions, even if not members of the above Association, to co-operate in its work by forwarding reports, publications, pamphlets, books, etc. which deal with this important branch of international agricultural economy.

The reception which these proceedings have met with incompetent scientific circles has been very favourable. Mr. A. JULL, Poultry Husbandman of the Bureau of Animal Industry, U. S. Department of Agriculture, wrote recently to M. B. I. C. te HENNEPE : " It is with great pleasure that I have learnt that you are accepting the proposal made by the International Association of Poultry Instructors and Investigators to prepare reports on aviculture for publication in the *International Review of the Science and Practice of Agriculture*. The appearance of the " Review " will be followed with the greatest interest ".

It is requested that all communications in regard to the editing of the Proceedings of the International Association of Poultry Instructors and Investigators be addressed to M. B. I. C. te HENNEPE, Diergaardesingel, 96 A, Rotterdam.

AGRICULTURAL INTELLIGENCE

GENERAL AGRONOMY

Agricultural Meteorology

147 **Research on Drought in Russia.**

I — DANILOFF Prof L, Posoukhy na Ukraini ikhnia Klimatologia ta synoptika — *Visnik Silsko Gospodarskoi Nauki* P. III, vypusk 10-12 Str 1 7, Buro Silsko Gospod Naukovogo Komitetu Ukraini Kkarkiv Kiiw 1924 (Droughts in Ukraina, climatological and synoptic research) *Messenger of Agricultural Science* Vol III, Nos 10 12 pp 1 7, Agricultural Bureau of the Scientific Committee of Ukraina Kharkow Kiew, 1924

II — ROTMISTROFF Prof B Posukka ta borotba snem (Drought and its control) *Ibidem*, pp 11-17 Kharkow Kiew, 1924

III — KOLKUNOFF Prof V Rolia selekzii v borotbé s posukhoiu (The role of selection in the control of drought) *Ibidem* pp 7-11

IV — OPOKIV Prof K, Meliorazia iak zasib borotbi s posukhoiu (Land improvement as a means of control of drought) *Ibidem* pp 18 22

V — LEBEDEFF Prof A Nabliudenia nad raskhodom vody potchvoiu pod aprelskim parom iarovoi pchenitzei i kukuruzy u Donskoi Oblasti — *Izvestia po Opytnomu Delu Dona i Severnago Kavkaza* (Trudy Selskokhoziaistvennykh opytnykh utchrejdenii), vypusk 4, str 108-134, Rostoff na Donu 1924 (Observations on the absorption of soil moisture in fallow land and in land sown with spring wheat and maize in the region of the Don) *Annals of Experimental Agriculture for the Don and the Northern Caucasus* (Work of Agricultural Experiment Institutions), Vol 4, pp 108-134, Rostoff on Don, 1924

VI — VIAZOVSKY P, Rol rastitelnogo pokrova v raspredelenii temperatur i vlajnosti v nijnikh sloiakh vozdukha 1924 (The effect of a covering of plants in the distribution of temperature and humidity in the lower strata of the air) *Ibidem*, pp 134-150 Rostoff on Don, 1924

VII — IVANOFF L Sovremennoe sostoianie voprossa o zasukhoustoïtchivosti rastenii — *Trudy po prikladoi Botanike i Selekzii*, Vol. 13, No 1, p. 3-32, 1922-1923 (Gosudarstvennyi Institut Opytnoi Agronomii). Leningrad, 1923 (Present position of the question of plant resistance to drought), *Bulletin of Applied Botany and Selection*, Vol 13, No. 1, pp. 3-35, 1922-1923 (Government Institute of Experimental Agriculture. Leningrad, 1923).

VIII — MOLIBOGA A, O sostoianii selsko-khoziastvennoi meteorologicheskoi sieti buro selsko-khoziastevennoi meteorologii Gesudarotvennago Instituta Opytnoi Agronomii po materialam sobrannym buro za 25 liet ego

deiatelnosti — *Isvestia Gosudarstvennago Instituta Opytnoi Agronomii*, P. II, No. 1-2, tr 33-36, Leningrad, 1924. (The System of stations organised by the Bureau of Agricultural Meteorology of the Government Institute of Experimental Agronomy, and data collected by the Bureau during the past 25 years).

IX. — MAKSIMOFF N. O programmakh i metodakh izutchenia zavisimosti rastenii ot meteorologicheskikh faktorow. (Scheme and methods for the investigation of influence of meteorological factors on plants). *Ibidem* pp. 34-40, Leningrad, 1924

The terrible calamity, caused by the disastrous harvest of 1921 in Russia, has aroused interest in the investigation of the causes which occasioned it. Deficient harvests, sometimes entailing scarcity, are unfortunately a well known phenomenon which recurs periodically in Russia at longer or shorter intervals. They are always brought about by drought which is more severe in the wide plains of South-East European Russia, a region pre-eminently wheat producing. The drought and disastrous harvest of 1921 were therefore neither the first nor the worst which have afflicted Russian agriculture The same phenomenon occurred in 1892, with much greater intensity. But never yet, before 1921, had the disaster amounted to a national calamity destroying, by famine and the disease which ensued, millions of human lives. Never before had Russia been obliged to have recourse to relief largely and generously organised by foreign countriee to check the ravages of the scourge which had fallen upon her. The reason of this was that formerly agriculture was in a normal condition and that an organisation existed for the control of scarcity; there was on one hand a vast system of reserves of wheat, which were renewed every year, while the reserve of the previous year was placed upon the market: there was a special reserve fund in cash, which was drawn upon to cover the expenditure on relief to be distributed in the districts suffering from food scarcity; there was, lastly, the system of means of communication, which worked normally and enabled a supply of wheat to be brought in good time to the distressed districts In fact Russia is so large, and climatic conditions are so diverse from one district to another of its territory, that the harvest can scarcely ever be deficient in all regions of production. It was at most, in exceptional cases, necessary to check or suspend for a time the export of wheat to foreign countries in order to meet the requirements of the famine-stricken districts.

This was no longer the case in 1921. Agriculture was exhausted and reduced to a condition of helplessness until then unknown. Reserves of wheat and capital no longer existed and the system of means of communication was totally inadequate. But the original cause of the calamity of the year 1921 was certainly drought, as it had always been in former years of bad harvests. Research on drought, its influence and means of controlling this scourge has therefore enormous importance for Russia, a country pre-eminently agricultural where all economic life depends always on the results of the harvest. Such research is also important for the other countries of Europe, on whose markets Russian wheat, sooner

or later, must again take the place which it formerly held. Also, it is of great interest to world agriculture, for drought, accompanied by deficient harvests, is also experienced in many agricultural regions. The observations, considerations and deductions of the Russian savants, whose names are given in the indication of the sources which have been made use of in compiling the present article, deserve therefore the whole-hearted attention of agricultural circles.

The Soviet Republic of Ukraina having suffered most from drought in 1921 and the production of wheat being very important for this country, the work of its savants was directed to research on this question. A complete number of the *Messenger of Agricultural Science*, published by the Committee of Scientific Agriculture of Ukraina, is given up to the subject. Besides the four original articles by Professors DANILOFF, ROTMISTROFF, KOLKUNOFF, and OPOIKIV, which are here reviewed, the number contains a series of reviews of the works of other Russian and foreign scientists on the question of drought.

The articles by the four authors just mentioned are distinguished from the other Russian papers by their decisive character. Working under the impulse of the urgent necessity of finding means of defence against an ever threatening calamity, they were led by their conclusions to recommend practical remedies. In the region of the Don and in the northern Caucasus drought is often still more disastrous than in Ukraine. Only two papers, by Professor LEBEDEFF and VIAZOVSKY, are available relating to that region. Both have a specialised character, are studies of local conditions and do not recommend means of control.

The largest and most dispassionately scientific paper is that by Prof. IVANOFF, published in the *Bulletin of Applied Botany and Selection* of the Institute of Experimental Agriculture at Petrograd. A critical analysis is given of the information on the resistance of plants to drought, no remedy is found for drought, but the author indicates the existing lacunae in the question and all obscure points which have still to be cleared up before practical measures can be recommended for the control of this scourge. Finally Messrs. MOLIBOGA and MAKSIMOFF, also of Petrograd, give a brief account of agricultural meteorology in Russia, its methods of work and the results obtained by its work during the past 25 years.

I. The paper by Prof. DANILOFF is devoted to the study of drought in the Ukraine from a meteorological point of view.

The author begins by giving some general data on the rainfall in the Ukraine. The North-West part of the country is described, a region on the borders of White Russia and Poland (basins of the Pripet and the Desna), which has an average annual rainfall of from 600 to 650 mm., that is to say, a higher rainfall than the eastern part of the European plain. To the South and South-East of that region, up to the latitude of Orqueieff-Ekaterinoslav-Lougansk, an average annual rainfall of 500 mm. is registered. Descending still further towards the South, a region with an average rainfall of from 400 to 450 m.m. is found, while the zone of the littoral of the Black Sea has only 350 mm. The culti-

vation of cereals only requires an annual average of 200-400 mm., hence the rainfall of the whole country should be sufficient for these crops. In practice however it is proved that this conclusion is erroneous. The error lies in the fact that in most cases, it is not the average rainfall of the year which is important but its distribution in the course of the year. A large part of the rainfall falls in winter as snow, and two thirds at least of that water is lost by running off when the snow melts and cannot be made use of by the crops. Torrential rains also carry off a large quantity of water, which runs away on the surface and is not of advantage to the crops. The author estimates that at least half the annual rainfall is lost in this way.

The prolonged periods of drought however are still worse, during which there is absolutely no rainfall. These periods of drought are repeated regularly at intervals.

The author, distinguishes two periods of drought which recur regularly in Ukraine, one in spring — April-May — the other in autumn — August-September. More prolonged droughts which affect a whole season also recur regularly, but at intervals of several years. Generally, the duration of droughts is also prolonged during more than one consecutive year, that is to say that after a period of several years of abundant rainfall there generally follows a period of some consecutive years of more or less intense drought.

In seeking the reasons which determine these periodic droughts, the author notes the relation which exists between drought and meteorological phenomena, the distribution of cyclones and anticyclones. Drought always occurs in regions of high barometric pressure All phenomena of high atmospheric pressure and all displacement of anticylclones are always accompanied by drought. Study of the path which displacements of anticyclones follow in their course, and the direction of that course, is therefore of very great importance, as it helps to determine the arrival of periods of drought and the period of their duration.

The following are the principal results of research undertaken by the author : — (1) Periods of drought of relatively short duration (not exceeding 12 to 15 days) occur as a consequence of a displacement of the maximum atmospheric pressure starting from a centre in the Iceland-Scandinavian region and travelling towards the South-East across Europe to the Caucasus. In its preliminary phase this phenomenon is accompanied by a sensible fall in temperature, especially at night, but afterwards it rises again ; the centre of maximum barometric pressure at that time reaches the meridian of the Dnieper.

This phenomenon occurs generally in spring and autumn. In summer, the centre of maximum atmospheric pressure lies much further South, although always with a tendency to displacement towards the East. It is in consequence of this situation that the tendency of the temperature to fall during the early days of the displacement is much less noticeable in summer.

In the more prolonged periods of drought, it is not the anticyclones which come from the West, but the atmospheric depressions which are

formed in Eastern Europe and even in Western Siberia which are most important. These depressions become stationary and push back the spheres of high pressure towards the South-West of the European plain. It is possibly a case of re-establishment of equilibrium between two centres of barometric waves which come into collision without co-ordination, one from the South-East of Europe and the other in the Lower basin of the Dnieper and on the shores of the Black Sea. The displacement of the region of high pressure, which is at the same time a region of drought, moves from the East westwards. The changes of temperature are not in this case so marked as in the former ; especially no fall in temperature is noticed during the first few days. These periods of drought generally occur in spring. Droughts of very long duration are accompanied by a displacement of the centres of high atmospheric pressure starting from the Atlantic towards Siberia with a widening of their base on the coasts of Scandinavia ; two centres of reduced pressure are thus formed - one in the northern part of the Atlantic, the other in the North-East of Europe. Consequently the isobaric lines of the centres of high pressure have the form of a triangle with curved sides, the centre of which is situated on the lower part of the Dnieper. Waves of depression pass over Europe one after another in an eastward direction ; in addition lesser waves descend from the North on Scandinavia. This phenomenon causes torrid droughts The re-establishment of equilibrium causes a driving in of the centre of reduced pressure to the North-West of Europe and a break of continuity of the anticyclonic zone in the direction of the parallels of latitude, forming an outlet for the centre of high pressure westwards.

The duration of this phenomenon and the extent of its development give the impression that it is the result of atmospheric waves of very great amplitude, whose undulations are prolonged for several months The observation of this phenomenon is one of the most recent advances of science in the field of weather forecasting. In this way the prediction of a threatening period of drought at a time more or less distant is therefore closely allied to the forecasting of weather more or less in advance.

Owing to the progress made in the study of meteorological conditions, together with the records of previous years, it may be hoped that the problem will be solved in such a way as to satisfy the exigencies of practical agriculture.

II. Prof. ROTMISTROFF deals mainly with farming processes which may be useful in the control of drought.

Formerly, care was taken in Russia, to accumulate snow in the fields during winter, to obtain the benefit of the moisture afterwards from its melting. Means had been devised for leaving in the fields the stalks of tall stiff plants, such as sunflower, sufficiently spaced to retain a large quantity of snow, to avoid its removal by wind and to slow down its melting in spring, in order that the soil might absorb a greater amount of water. Partial re-afforesting of the steppe was also recommended again with the object of forming a wind-break and of preserving the humidity of the air if not that of the soil in the neighbouring cultivated fields. The

snow on cultivated fields was also covered with ashes to cause a rapid melting and the absorption of the water on the spot, the snow which remained preventing the running off of the water along the surface. Snow was also accumulated in trenches between the ridges.

All these methods have been found insufficient, or even quite illusory, and have not proved of practical application.

It has since been proved that the water always runs off at the surface so long as the ground is frozen, that is to say so long as it is covered with snow, and that it is only after the melting of the snow that it can infiltrate and be stored in the ground. Consequently it is the autumn rains which are most important from the point of view of the water utilizable for agriculture. The autumn rain infiltrated in the soil remains there, for it is held in the soil by frost. The winter snow gives no increase of humidity ; it loses by evaporation and by running off on the surface when melting, and the field has not generally in spring more than the same degree of humidity that it had in autumn. It is necessary therefore in the control of drought to utilise as much as possible of the humidity of the soil, by avoiding its useless waste and by attracting to the vegetable soil the reserves of moisture which lie in the sub-soil. In studying the records of soil humidity collected during a period of 25 years, from 1887 to 1912, in the experimental fields of the Odessa agricultural station, the author reaches the following conclusions:

The Odessa region is often subject to drought, the average annual rainfall not exceeding 320 mm. It has been calculated that 1 mm. of rainfall corresponds to 450 *pouds* of water per *dessiatine*, and that to form 1 *poud.* of dry vegetable matter, 400 *pouds* of water are required; a rainfall of 1 mm. suffices therefore for the formation of 1.5 *pouds* of grain and straw, and a rainfall of 320 mm. could give 480 *pouds* of dry matter per *dessiatine*, which according to ordinary calculations corresponds to a crop of 140 *pouds* of grain and 320 *pouds* of straw per *dessiatine* (about 25 q of grain and 520 q. of straw per ha.). Now it is evident that these results would give an immense crop for Russia. But in this calculation the inevitable losses of water have not been taken into account. There are firstly the showers of short duration which only affect the surface of the soil, there are next the torrential rains part of which is lost by running off at the surface ; lastly there is the snow, which does not enter into account for agriculture. The author estimates that on the average only about 200 mm., out of the annual 320 mm., are profitable for agriculture. This quantity of water would still allow for a crop of about 100 *pouds* of grain and 200 *pouds* of straw per *dessiatine* (16 q. of grain and 32 q. of straw per ha.), which would still be a very satisfactory yield. It is considered that a quarter of that quantity still constitutes a satisfactory crop for years of drought. The evident conclusion is that a large quantity of the moisture available for agriculture in generally lost.

It is this loss of moisture not utilised by agriculture that the author mainly wishes to avoid, and it is in agricultural methods designed for this object that he sees the most effective means for counteracting drought. In his opinion, the run off of water during the heavy autumn

rains must be checked. In order that the rain may be rapidly absorbed by the soil, the upper layers should be well broken up to a depth of about 5 to 10 cm. The surface of the field should not, however, be perfectly flat and level, so that the stratum of air which is in immediate contact with the ground may not be constantly displaced and renewed by wind, which would dry up the soil. The most advantageous agricultural method is that which leaves the surface of the ground covered with small clods the size of a pigeon's egg The clods themselves will dry up very quickly, but they check the circulation of the air between them and, to that extent, prevent the drying of the soil between and beneath the clods.

Surface tillage carried out with light instruments, cultivators, weeders, hoes and harrows should be repeated very often It should be begun immediately after the harvest, the stubble being first pulled up which starts evaporation by drawing the moisture to the surface and by increasing the evaporation area. It has been observed that if the stubble remained standing the soil would become perfectly dry in from 8 to 10 days after heavy rain of 12 to 15 mm In carrying out the work the stubble should merely be uprooted, without turning over the layer containing the roots, or a still greater drying up of the whole layer would result; it is not therefore a matter of burying the stubbles but only of uprooting them as they are removed with a harrow subsequently Surface tillage should be repeated about every fortnight to maintain the upper layer of the soil in the desired condition The author considers that this procedure would, in most cases, save a large quantity of moisture which would otherwise be lost, and that it will also be effective in the control of drought

III. Prof KOLKUNOFF, considers that the best safeguard would be found in the selection of xerophilous types of cultivated plants It is not that he does not fully recognise the importance of tillage methods, but considers that this side of the question has already been very fully studied, while hitherto little has been done respecting the types of cultivated plants most resistant to drought He finally recommends a suitable rotation of crops and a system of cultivation It is doubful whether the deficiency of moisture in the soil is the only cause of low yields in times of drought If this doubt is well founded, it is evident that means devised for accumulating moisture in the soil do not sufficiently safeguard against drought. Hence it is not sufficient to rely on cultivation methods which can only regulate the amount of water in the soil.

The author first of all investigated the peculiar properties of plants resistant to drought, and the indications by which they can be recognised. It is generally thought that the most essential property of such plants is a well developed root system ; deeply penetrating tap-roots are no doubt able to imbibe moisture from the lower strata of the soil. However, this property is not alone sufficient, as the soil may contain enough moisture and yet the plant may none the less suffer from drought in certain conditions as proved by experiments. The plant will suffer from drought as soon as the amount of moisture transpired by the leaves exceeds the amount supplied by the roots. The writer terms this " physiological drought ". The ligneous vessels of the plant can only conduct a certain

quantity of water to the leaves. Water must therefore be accumulated in the soil but it is still more necessary to prevent excessive evaporation from the plant itself. There are two means of effecting this object. The humidity of the air may be maintained and re-afforestation has always been recommended for this purpose ; but this measure is neither very certain in its effects, nor easy to put into practice, as it requires heavy expenditure and much time. The second means is to find or select types of plants which transpire as little as possible.

It has been observed that plants of winter growth are generally more resistant to drought than those of spring ; they are also able to stand cold better and the attacks of insects

The problem therefore is as follows :— We must, by selection, create types which transpire little moisture, have deep roots, can be grown in winter, and are very resistant to cold and pests.

As regards methods of procedure, the author indicates three :—

(1) the selection of individuals suitable for creating pure lines ;
(2) importation of foreign plants ;
(3) the creation of new types.

The method of importation of foreign plants is eliminated as it has been tried for wheat and has given unsatisfactory results, the imported wheats very soon lost their essential qualities, and only gave a much lower yield than indigenous wheat.

The indications of resistance to drought which may serve to give direction to research on selection and the creation of new types are :—

(*a*) The development of the root system
(*b*) The intensity of transpiration by the leaves.
(*c*) The resistance of the plant to drying up of the vegetable tissues

The last category, however, is at once discarded, since no plant resists drying up without prejudice to its yield. As regards development of the roots, it is curious that plants which have the most largely developed root system are precisely those which are least resistant to drought ; this is explained by the intervention of the factor " physiological drought " mentioned above. As a matter of fact the intensity of transpiration is very great in the leaves of these plants, and their growth would only result in impoverishing the lower stratus of the soil by consuming the reserves of moisture.

Selection therefore can only be directed to the intensity of transpiration by the leaves. Recent research by the author and his collaborators has shown that the intensity of transpiration does not depend on the size, nor on the number of the stomata, nor on the diameter of their ostioles, but exclusively on the size of the cells in all tissues of the plant. This is explained by the fact that the rate of passage of water through the cells, and therefore through the vessels, must necessarily depend on the size of the cells. There are great differences in plants as regards the size of the cells, not only between different varieties or types, but even between individuals of the same type. The author even considers that it is possible to find in this character a sufficiently great diversity for form-

ing a whole " biological scale ", and thinks it possible to create new lines on the basis of this character. He has crossed a type of wheat with broad leaves and medium sized cells thus ensuring vigorous growth in the new plant, with another type having narrow leaves and small cells. The result has been the creation of a new type of winter wheat resistant to drought, and which has already reached the F_4 generation. It is on these lines that he would wish to direct further scientific research and large-scale experiments in the practice of agriculture, by extending the field of these researches to all species of cultivated plants.

The author then discusses the rotation of crops, and considers that cereals with deeply penetrating roots exhaust to a great extent the reserves of moisture in the lower strata of the soil and hence a great decrease in the number of bacteria in these strata is brought about which renders the soil infertile. Cereals should therefore never be sown for two successive years on the same field, as is generally done with the triennial rotation (fallow, winter cereals, spring cereals). On the contrary, plants with a differently arranged root system, with spreading surface roots, should be introduced into the rotation. Leguminous plants and root crops satisfy these conditions. They transpire less moisture, and hence, leave a large reserve in the lower strata of the soil and thus favour the development of bacteria. The rotation of cereals with plants having more widely spreading and more superficial roots is especially important during years of drought. Hoed crops have the further advantage that they are well suited to cultivation in lines sufficiently far apart for a horse to pass between, which enables the field to be cultivated every fortnight (indispensable in years of drought).

The author therefore recommends replacing the present triennial rotation — fallow in pasture, winter wheat, spring cereals — by a five year rotation as follows: — (1) Winter wheat. (2) Late hoed crops (potatoes). (3) Spring cereals. (4) Late hoed crops (mangolds, carrots). (5) Early hoed crops (peas, beans, flax). With this rotation, cereals would always come after hoed crops which accumulate reserves of moisture in the deep strata. It is seen therefore, that the author recommends for the control of drought methods which involve a change of rotation, the removal of stubble and weeds, frequently repeated surface tillage and, lastly, the creation of types of plants resistant to drought.

IV. M. Opokiv, values very lightly all those measures which have only a palliative character. The accumulation of reserves of moisture in the soil and sub-soil on one hand, and economy in its consumption by means of diminished evaporation on the other, may help to obtain a fair crop of winter wheat in season of drought, but could never ensure a good yield when the rainfall is insufficient and, as for spring crops, all these measures remain powerless to make them profitable. In fact, all processes of dry farming become useless at a certain point when the air and the soil become heated, in a season of drought, up to 60°C. In such a case the growth of whole fields has been seen to wither and perish in two or three days and then only an abundant rainfall could have saved the crops. Heat keeps pace with drought when anticyclones

occur, and even during ordinary seasons less intense and less prolonged periods of drought may exercise a disastrous influence on the crop, if they occur at such times in the growth of the plants when the need of moisture is more strongly felt. Prof. BROOUNOFF has very well named these times "critical periods" of growth, from a meteorological point of view. These critical periods are generally seed time and subsequently periods when vegetative growth is most intense. Plants therefore need certain definite quantities of moisture, available at different phases of their development, and to obtain a good crop, that moisture is absolutely essential.

The writer sees only one effective remedy against drought, whether prolonged or temporary, namely irrigation. In order that the best results may be obtained from irrigation the water must be supplied to the plants in the form to which they are accustomed, that is in the form of an artificial rainfall.

Experiments of mechanical watering have shown that, even in normal seasons a surplus yield of from 100 to 200 % is obtained with this method for the principal crops, owing to the suitable distribution of the water supplied to the plants, the phase of growth through which they are passing being taken into account. The only objection which can be raised to this method is the heavy expense involved and the quantity of water which must be available. But the Ukraine has a sufficient number of rivers, springs and wells to provide for this requirement. The same rivers could also supply the power necessary for a system of electric stations sufficient for the distribution of the water required for agriculture. The cost of constructing such a system to supply the hydraulic requirements of the country would be enormous, but not beyond the financial resources of the State, and the expenditure would soon be repaid with full interest, owing to the additional yield of all crops.

The author thus returns to the great projects of electrification of the country, much discussed in Russia five years ago and which naturally have never been realised on account of their very magnitude.

V. The paper by Prof LEBEDEFF, relates exclusively to conditions of growth in the Don region. The normal climate of that region is described as particularly unfavourable for the growth of cereals, especially for spring cereals. In fact, in the steppes of the Don the heaviest rainfall occurs during the months of June and July, while the spring season is generally very dry. Spring wheats have not therefore the amount of moisture which they require at the commencement of their growth, while the summer rains often hinder the harvest and damage the crop. Nor are these rains of use for the subsequent sowings, since the humidity is not retained long enough in the soil, and the months of August and September are always dry. The farmers endeavour to avoid this drawback by giving preference in spring to the planting of late plants, such as sunflowers, maize, mangolds, which can benefit by the summer rains and which are harvested in August and September.

The author carried out a series of experiments in order to ascertain the varying losses of moisture by the soil as consequent on the

rotation most commonly used in the country, namely : — fallow, winter wheat, barley, maize, spring wheat, barley. He has measured periodically the moisture of the soil in each layer of 0 5 cm., down to a depth of 2.5 m. and separately for each field of the rotation indicated. To determine the degree of moisture of the soil, the samples were dried at a temperature of 105-110°C by means of a current of air, until the weight of the sample became constant. In the course of these experiments it was found that wheat was more susceptible to variation in supplies of moisture than maize, especially on account of the distribution of its stages of development according to season, in fact wheat suffered much more than maize from drought in spring. For the production of a given quantity of grain, wheat requires more moisture than maize and, curiously, the consumption of moisture for a given quantity of grain is greater for wheat during dry than during moist years The author explains this by observing that the vegetative organs do not economise in the moisture which they consume, they draw from the soil all the moisture they can, in developing their foliage, which increases transpiration ; if drought occurs afterwards and the moisture remaining in the ground is insufficient, the grain develops incompletely and the crop yields more straw than grain He terms this " biological drought ". Species of plants with periods of growth as short as possible and which yield less straw, should therefore be selected, especially for years of drought

The results reached by the author in his experiments are formulated in the following conclusions :—

(1) Fallow does not cause any accumulation of moisture in the soil in spring

(2) The reserve of moisture in spring in the strata of the soil occupied by the roots of crops, to a depth of 125 cm , does not depend on autumn tillage nor on the previous crops

(3) Wheat and maize, after the harvest leave similar quantities of moisture stored up in the soil ; these two crops therefore have the same agricultural value for the crops that come after them

(4) The stratum of soil ordinarily occupied by the roots — from 0 to 125 cm. in depth — always accumulates a large amount of moisture towards spring, 50 % of which comes from the winter rainfall and 16 % from the annual rainfall ; this accumulation of moisture in the upper layers of soil should be attributed to the condensation of aqueous vapour which is set free in the lower strata of the soil

VI The paper by Prof. VIAZOVSKY contains fewer suggestions which are capable of being used directly for the control of drought than that of Prof LEBEDEFF The facts ascertained in the course of his experiments and of his careful observations, the results of which are recorded in a series of tables, while they have enabled known facts to be verified and confirmed, have not, however, resulted in many new conclusions.

It is known that active vegetation produces under the shade of its cover, peculiar atmospheric conditions differing from those of the surrounding area which is not covered with vegetation. The temperature and the degree of humidity of the air are quite different under the cover of plants

and outside such shelter. This difference is maintained, not only under the influence of daily sunshine, but also at night. The absolute and relative humidity of the air is always greater, not only under the cover of plants, but also in the strata of air immediately above them, in comparison with those registered at the same height where the ground is bare.

The air passing over a field covered with vegetation therefore becomes charged with humidity which is transported as the air moves. The temperature always being lower under the shelter of foliage, even during the night, with saturated humidity, than in the surrounding air with a bare surface, it is evident that these phenomena depend exclusively on radiation, and not on transpiration of the leaves At the same time, the temperature is much more constant under the shelter of foliage. The author found that the temperature under these conditions remained relatively high, not only during sunshine, but also in the early hours of the morning.

It is well known that oats seldom succeed in the region of the Don and the Northern Caucasus The author places this fact in correlation with the recently observed fact that the ostioles open and remain open for a long time when the temperature, reaches 30°C., and that after 4 or 5 hours, all the starch in the plant disappears, being transformed into sugar and carried away in solution in the sap The same phenomenon has been observed for spring wheats after 10 to 17 hours under the influence of the same temperature, and for winter wheats and barley after 20 to 35 hours. It is evident that, in these conditions, the plants yield scarcely any grain. Oats are also subject to another drawback in the climate of this country ; even during the most favourable seasons, the grain ripens too early, while the stalks and the leaves are still green.

VII. The work of Prof. IVANOFF is a general paper, of much larger scope than the former articles Its general character of critical analysis and its importance for giving direction to further studies have already been indicated. The following is a more detailed review.

Although it is well known that transpiration by the leaves of plants is infinitely greater than is necessary for the production of plant substance, M. IVANOFF does not agree with the opinion of those who consider such transpiration superfluous and who would restrict it by all means. It is true that mineral elements can penetrate into plants independently of the absorbing action of transpiration as is the case with aquatic plants ; it is therefore osmosis on one side and the pressure of the roots on the other, which causes movement of the sap. However, to get a rapid ascending movement, without loss of energy caused by the pressure of the roots, transpiration must necessarily intervene. The author remarks that the ascending sap not only contains mineral but also organic substances, sugar and enzymes (amylose and oxydase). To render possible the exchange with the liquid of the cells, the concentration of the sap must not be too great but it must pass in large quantities. Moreover, experiments and observations have clearly shown, that when transpiration decreases noticeably, for example on account of excessive humidity of the air, the crop becomes abnormal and defective, not only in quantity but also in quality. This is explained by deterioration of the tissues of

the plant, under the influence of decreased transpiration. In fact, the intensity of transpiration and the quantity of liquid transported determine the degree of turgescence of the plant, which has, like every character, its "optimum" point, very important for resistance to cold and pests. Transpiration therefore acts as a regulator for the influence of the temperature.

The author then discusses the indications of xerophilism, which in his opinion are still far from being decided. The action of the stomata, ostioles, hairs, the cuticle and wax, as regulators of transpiration has not yet been properly defined. Certain writers think that the width of the ostioles and the opening of the stomata do not correspond with the intensity of transpiration, the opening of the stomata depending rather on the light and the stomata serving rather to store up the carbonic acid gas of the air, than to transpire moisture. KOLKUNOFF's discovery, previously referred to, is not, in the author's opinion, either really conclusive or clearly explained theoretically. He considers the size of the cells as a merely empirical indication of xerophilism, and attributes no greater value to the point than to the observation that the number of stomata is not reduced in xerophilous plants ; the same is true for the number of hairs, the thickness of the cuticle and of the layer of wax which covers it.

The methods of investigation need improvement and attempts should be made to measure exactly the diffusion and traspiration through the stomata, and the registration of transpiration should be done not only in the laboratory but also in the open field, in normal conditions of the life of the plant For the moment, there is not yet any acquired knowledge except the conclusion that the so-called xeromorphous structure of the plant is not a sure indication of decreased transpiration, and still less of resistance to drought.

None of these so-called indications is sufficiently established to serve as a basis for a work on selection, with a view to obtaining subjects and lines of plants resistant to drought. Moreover, the intensity of the process of transpiration by the leaves is far from corresponding always with the resistance to drought ; in other words, it is not always the plants which resist drought which transpire the least moisture, and vice-versa. Neither is it known whether the intensity of transpiration decreases under the influence of drought, nor in what manner such reduction takes place when it is produced.

Other indications of xeromorphism in the structure of the root system have been sought for, but no clear result has been reached. Fortunately in this part of the research it was possible to make observations on plants growing in a suitable environment. Resistance to drought depends in the first place on the power of absorption of the roots, and next on their structure. The power of absorption can be measured by the plasmolytic method, by the osmotic pressure. It has been found that the osmotic pressure increases with the drought and in certain plants can attain up to 40 and even 100 atmosphere, varying always up to a certain limit for each species of plant. As a rule, however, the capacity of absorption of the roots exerts a more decided influence on the rapidity of absorption of moist-

ure by the plant, than on the quantity of moisture which is supplied to it. The degree of humidity of the soil at which the supply of moisture no longer suffices to cover its loss by transpiration has been calculated for various plants; that value has been called "the wilting coefficient" and it has been found that the variations from one plant to another do not exceed a limit of 10 %.

It should also be remarked that the whole of the moisture contained in the soil is not accessible to plants, for a certain amount of water is always retained in the soil, in virtue of the capillarity and the hygroscopicity of the colloidal particles. The richer the soil is in humus and colloidal matter, the greater will be the amount of moisture which remains inaccessible to plants. In these limits, the plants which have the power of increasing osmotic pressure, owing to absorption by the roots, are in the most favourable conditions for resisting drought, and selection, based on this character should be possible. Moreover, the arrangement of the roots and rootlets in the soil must also have an influence. If the distance between the rootlets is sufficiently large, so that the zones of soil drained are not in contact and the ascending movement of the moisture is very slow, part of the capillary moisture contained in the rhizosphere will remain unutilised. The structure of the root system will therefore correspondingly increase the resistance of the plant to drought according as the rootlets are sufficiently well developed in the strata of the soil containing available moisture, to utilise the whole of that moisture. But these strata of the soil not being always necessarily at a great depth, even in dry localities, it is not surprising that it has not been possible to establish a necessary correlation between the resistance of the plant to drought and the length of its roots.

Among indications of xeromorphism have also been reckoned other characters whose importance cannot be denied, but the comparative study of which is still very imperfect These characters include the capacity of the plant for conducting water from the roots to the leaves, passing through the stalk. It is evident that the structure of the vessels, which conduct the ascending sap, must play an important part in resistance to drought, but up to the present study of this question has not given other indications than the simple fact that xerophilous plants have a fuller vascular system than plants which have little resistance to drought. It is also known that the capacity of the plant to absorb moisture through its roots does not always correspond with that of conducting it to the leaves through its vessels; in these conditions the vascular system may become a limiting factor for the supply of moisture to the plant. But the relation which necessarily exists between this factor and resistance to drought must still be made the subject of further research.

The contribution of moisture by the atmosphere is certainly possible and should have an influence in resistance to drought. It is stated that the plant is unable to utilise directly the aqueous vapour in the air, although its presence exerts an influence on the intensity of transpiration of moisture by the plant. As regards dew, it is certainly absorbed directly by the plant, but it is not known what part this factor plays in resistance to

drought. Sprinkling experiments on plants and the observation of the effects of showers of short duration indicate that if the temperature is high and the air very dry, this contribution of moisture may often become harmful to the plant. The phenomenon, indeed, has been observed, but not yet explained in a plausible manner, that these sprinklings render transpiration so active that as a final result the loss of moisture exceeds the supply, and the plant wilts This question also deserves further research. Still further indications on the possibility of utilising certain peculiarities in the growth of plants for the control of drought are found in the literature on the subject. These peculiarities, which are in fact anomalies, are the phenomena known under the names of nanism, anabiosis and ephemerality. Nanism in the faculty which plants have of reducing their size under the influence of drought In spite of its restricted development, the dwarf plant is able to produce fruit and seeds which have the power of germinating, but for cultivated plants the yield is naturally much reduced If the plant is affected by drought, not from the commencement of its growth, but when growth is already finished, some plants lose a large portion of their leaves and reduce their vital functions to a minimum ; they enter into a phase of torpor and repose, to renew their vegetative vigour as soon as rain occurs , this is termed anabiosis Certain of our cultivated plants have this power, which could perhaps be turned to account to counteract a drought of short duration, but the question has as yet been too little studied sufficiently to formulate any conclusion

The same is true for the question of ephemerality, which is the capacity of the plant to change its habit of life so as to become acclimatised to an arid region, that is to say to reduce the duration of certain phases of development utilising for development the dampest periods only of the climate. It is thus that the wheats of Turkestan develop from their germination, so vigorous a vegetative activity that they come into ear long before other kinds, and with an astonishing luxuriance of vegetation ; the second part of their life, up to maturation, is on the contrary very inactive and slow. This peculiarity enables them to support the spring drought without harm and to await the late rains in June. Lastly, the low temperature of the soil in spring in Central Russia favours resistance to drought in oats by checking the development of the foliage, while the roots maintain a normal growth ; the plant having few leaves transpires less moisture and stands the drought well

All these peculiarities are phenomena of acclimatisation, which deserve full attention in the study of the control of drought. Prof IVANOFF notes the great complexity of the problem and the absence of definite results in its research. Not one of the indications of xeromorphism in our cultivated plants is as yet quite certain. Now, the problem to be solved is to find, even by empiric methods, a xerophilous type of each cultivated plant and for each climatic region. Laboratory experiments are not sufficient for an adequate solution of this problem, they must necessarily be combined with observations of plant life as displayed in normal conditions and their results must be confirmed by such observations.

It is also necessary to define what is to be understood by " resistance

to drought ", that is to say, what is the degree of drought which becomes injurious for each crop in each locality, and what are the manifestations of drought which cause injury to crops, whether it is deficiency of moisture in the soil, or dryness of the air, high temperature, too intense sunshine or mist, which damages any particular crop. In fact the capacity of resistance of plants to each of these injurious influences is certainly different . Lastly, the relation between the periods of drought and their duration on the one hand, and the phases of development of cultivated plants on the other, must be studied. Needless to say that comparisons between one plant and another are only to be made in this research with great discretion, and this not only because of the properties of each type of plant, but also in view of the different objects of their growth, since it is, for example, in one case the seed, in another the root which forms the most valuable part of the crop. This work may therefore be considered in the first place as an ecological investigation. The conditions of the medium, the meteorology of drought, must first be studied; research should next bear upon the morphology, anatomy and the phenology of cultivated plants, to finish with the study of their physiology, always from the point of view of their resistance to drought. The question having the character of a purely ecological problem, we must begin by elaborating methods which may lead to solution, seeing that ecological methodology is still in a rudimentary state

VIII. The articles by MOLIBOGA and MAKSIMOFF do not directly attack the problem of the control of drought in Russia, but they afford some idea of the scientific apparatus existing in Russia which could be used in the execution of the full research proposed by Mr. IVANOFF.

Mr BOLIBOGA states that the system of agricultural meteorological stations, established in Russia on the initiative of Prof. BROOUNOFF in 1897, had begun to have a more or less important development just before the war. Fifty three of these stations were established in Russia in 1913. Since then, political events have not only stopped this development, but have even destroyed a part of the work done. A commencement has been made to re-establish, it, but in 1923 the system contained only 33 stations, most of which had insufficient apparatus. The Central Bureau has collected and preserved an enormous quantity of material recorded by the stations during the whole of the past of years, but this material still awaits elaboration.

IX. M. MAKSIMOFF sketches the programme of research in agricultural meteorology, partly undertaken, partly to be continued, with a view to the control of drought. The factors to be studied are : — the atmosphere, the water supply, the properties of the soil, temperature, light, and the combination of these factors in variations of weather.

Changes of weather should be studied in their relation with the various phases of development of plant growth. It is necessary to determine for each crop the " critical periods " in Prof. BROOUNOFF's sense.

As regards methods, a series of parallel observations should be made on the normal conditions of plant growth and on artificial conditions under glass and in pots.

The author indicates the principal objects and methods of research in the open field, namely :—

(1) Sowings at different times and phases of development.

(2) Sowings in different localities and in different climatic conditions.

(3) Experimental irrigation. This method, by elimination of the principal factor, *i.e.* the water-supply, would make possible the separate study of the influence of temperature and light. To eliminate these two last factors, recourse would have to be had to growth under artificial conditions. It is possible to regulate and vary the influence of light by the use of screens. It is possible to supply plants in greenhouses with more or less dry and more or less warm air. Growth in pots has certainly the drawback that the root system is always somewhat compressed. For this reason this method is not suitable for research of a complex nature, but it may well be used to determine separately the influence of each factor, for example, the humidity of the soil, the amount of water consumed, the coefficient of transpiration, etc

The interpretation of all results of investigations on growth carried out in artificial conditions requires great care. G. Z.

148. **Agricultural Meteorology in Italy.**

PAOLONI B La meteorologia agraria in Italia *La Meteorologia pratica*, Year VI, No 3, pp. 93-107. Montecassino, 1925.

The author of this article, Father B. PAOLONI, a student of meteorology, has for many years endeavoured to make practical application of purely scientific meteorology to the requirements of agriculture, which in Italy is of vital importance to the country. According to the author, one of the principal shortcomings of the Italian meteorological service is perhaps that not only does it still remain too much in the purely scientific stage, but to this is added the very serious defect of want of adequate means and of concentrated effort

In Italy, where it may be said that pure and agricultural meteorology originated (the first phenological observations were made in the Orto dei Semplici at Florence in 1810 and compared with meteorological data of the corresponding period), and where up to a few decades ago through the medium of descriptive articles and the work of students of the science, such as Conte ALMERICO DA SCHIO and Dr. LAMPERTICO, much might be learnt even by foreign countries, the situation is now one of absolute inferiority, compared with many other countries.

Attempts have been made to coordinate, over wide zones, meteorological agricultural observations, making at the same time investigations as to the principal families of cereals and the chief varieties of fruit trees, but after a short time, for one reason or another, the movements, even when supported and actually promoted by the Government (as in 1886) have failed. Today there exists in Italy the *Rivista Meteorico-agraria*, published under the auspices of the Central Observatory of Meteorology, but, apart from its modest dimensions, it is solely devoted to general

agricultural meteorology and, moreover, a large part of the observations relative to agriculture reported in it are not the work of specialists nor even of persons of real specific competence. Today, except, for some private movements (of which the most impotant, if not the only one, is the meteorological system existing in Terra di Lavoro, founded and managed by Father B. PAOLONI) there no longer exists any indication on the part of competent organs of a serious intention of dealing with the matter.

Under this scheme there have been and still are collected the principal meteorological reports relating to phenological data of a considerable number of plants, subdivided into nine groups:— cereals, fodder plants, leguminosae, industrial plants, vegetables, vines, olives, fruit-bearing and forest trees.

On the side of the Ministry of Agriculture, in consequence of the increasingly great diffusion in foreign countries of ecological researches tending to determine the *characteristic environments of each plant and the most favourable conditions for perfect growth*, an attempt was made some years ago to start in Italy a service of agricultural meteorology which, without being as extensive as that which existed in Russia before the war, might however form a solid starting point for the definite organisation of this most important branch of agricultural research.

Unfortunately, however, partly through a great disproportion between means and the object and perhaps also through want of enthusiasm on the part of those from whom it might have been expected, even the circulars sent out with this object remained dead letters and the inconsiderable amount (L. 45 000 a year) assigned to this object was not even fully utilised

The capital mistake, however, at the outset was to try to duplicate the Central Bureau of Meteorology, instituting a new centre of collection of meteorological-agricultural reports in the Ministry of Agriculture, when the Central Bureau already organised to receive reports from all sources, and only requiring more adequate economic means and improved methods, could very well have done the work. Nothing, however, has so far been achieved, but there is every reason, in the present necessity for increasing the production of wheat, to apply to that end the aid that could be given by meteorology.

Meteorology is among the very first of means. Without asking, even remotely, for such a sum as the 50 millions which the United States spend annually for the agricultural meteorological organisation, without asking, at present, for the magnificent French organisation which is instituting in each commune a radiophonic station which four times a day will broadcast to the farmers the forecasts of the Central Observatory for the following 24 hours, it is possible to establish by a single act of goodwill a really practical and useful service placing it under the Central Bureau in Rome, the new service to be charged with the duty of supplying farmers with the following daily items:—

(*a*) Regular forecast of a general character, once or twice a day.

(*b*) Notice of periods of fine weather with the progress, for the region, of the more important meteorological phenomena.

(c) The termination of the periods.

(d) Announcements of frosts and storms, especially hailstorms.

(e) Peculiar hygrometric conditions favourable for the spread of parasites and diseases especially injurious to certain plants.

The forecast for the 24 hours is now accurate 90 times out of a 100; the local experience of each farmer would supplement and improve the forecast in each centre.

Nor would this be the only collaboration which might be required of the farmer himself; he also should despatch for each place periodically, to the Central Bureau, such information as, after careful consideration, would permit of the periodic compilation of a general statement of the meteorological-agricultural situation of the country and of its immediate and remote agricultural prospects. There will thus be the possibility, in each region, of the adjustment of the growing of various crops to the climate and minimum amount of the summer rainfall.

This is not a small matter as in Southern Italy where delay in sowing wheat from faulty estimation of the duration of rainy periods, may lead later, in the dry season, to loss of the crop with damage of over 500 million lire An equal or even greater loss may occur in the case of forage plants, and other large amounts for vines, olives, fruit and vegetables, so that over two thousand million lire a year is at stake, and may be saved by an efficient agricultural meteorological organisation.

A FA

149. Methods of Weather Forecasting.

ROUCH J Les méthodes des prévisions du temps, pp 280 Félix Alcan, Paris, 1925

New methods in relation to the forecasting of weather with reference to its application to agriculture have been suggested by VERCELLI

The work in question omits all preliminary matters, and deals only with the subject of *forecasting*, referring in certain instances to former works by the same author on static and dynamic meteorology. In the 280 pages of the volume, various methods of forecasting are considered and discussed in sufficient detail.

The book is divided into three parts

Empiric forecasting, local forecasting, general forecasting, on the basis of simultaneous observations made on a large scale The first naturally forms a large section dealing with the knowledge transmitted by means of proverbs, aphorism relating to various phenomena, observations of the behaviour of certain plants animals, etc.; a very large mass, the value of which is in many cases disputable, but the interest of the subject is not thereby lessened.

In the other two parts are set out the methods of scientific forecasting. There are naturally differences of opinion, due largely to the incomplete knowledge possessed with respect to the atmosphere and particularly as regards solar radiation. Moreover many lacunae still exist in the knowledge of the relations between statosphere and trophosphere, the basis

factors being absent, which might serve as criteria of the principles of weather forecasting.

These, on the other hand, vary according to circumstances and according to certain types of weather so that a method may from time to time prove effective or not even allowing that in its application there may still be, to a certain extent, empiricism, and the factors of individual skill.

On the other hand, no rule regarding such a complex matter as forecasting must be too narrow and rigid, and a selection from the standard methods is necessary. The author admits that this procedure may be slightly unscientific but is due to the early stage of the young science in question.

It would indeed be a mistake to derive a rule of general application from the formula of a standard method, whereas the wise use of its fundamental elements may always furnish and constitute a useful contribution to those already possessed, leading to the elucidation of the problem the manifold aspects of which constitute its difficulty. A. FA.

150. **Principles of Practical Weather Forecasting.**

SANSON J. La Prévision du temps *La Vie Agricole et rurale*, Vol. 26, No. 22, pp. 353-356, Fig 2. Paris, 1925.

The author discusses some of the principles of practical weather forecasting, chiefly founded on records of the wind and clouds, of animals and plants, with a short note on the atmospheric "parasites" observed by means of radio-telegraphy. The importance which the observation of clouds, especially in recent years, and particularly, the higher clouds — usually cirri — heralding the arrival of depressions, has assumed, is noted. From these observations it is possible to deduce some general principles which have considerable practical value

(1) With light winds, variable in direction and with a sky almost free from clouds, with morning mist or abundant dew, there is in all probability an anticyclonic condition (high pressure). A certainty of settled weather is then probable. However, with light southerly winds accompanied by a rise in temperature, especially in the morning, and with high cumuli scattered over the sky, thunder storms or atmospheric disturbances are to be feared, especially in summer. Regular daily variations in the velocity of the wind, that is to say the passage from a light current in the morning to a more considerable current, coincident with the maximum temperature of the day and with decrease at sunset, indicate a settled condition.

On the other hand a change of weather is to be predicted, if in the course of a fine day, the wind continues to remain strong in the evening and at night.

Rapidly moving cirri, coming from a direction between south and north-west (3rd and 4th quadrants) should give reason to suppose, especially in May and October, that a depression is coming whose centre is

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situated slightly to the right of the direction from which the clouds come.

These cirri may precede the depression by 24-48 hours, according as the observing station is situated on the edge or in the centre of the nebulous mass; in this case rain or dry weather will depend on the distance of the station from the centre of the depression. The appearance of high cumuli coming from the above-mentioned direction may give similar results.

(2) By forecasting the direction of the wind, it is possible to predict changes of weather. Indeed, for a given place, certain almost constant characters of the weather correspond with the direction of the wind. For each station it is therefore possible to draw up special charts of frequency of the wind according to the various directions, i.e. graphs which illustrate the atmospheric currents apart from their intensity According to the prevailing directions, observation will disclose types of weather not liable to change while the conditions which have determined them continue.

(3) Certain aspects of the atmosphere also furnish good indications for a local weather forecast. Rain is preceded by exceptional clearness of the air, by better perception of distant sounds (especially those emitted in the direction of rainy winds), by increased twinkling of the stars, by the occurrence of solar and lunar halos (especially the former), by the fact that the clouds are massed in the direction towards which the wind is blowing and by other indications of minor importance which may naturally vary from one region to another, especially in countries round the Mediterranean. The various colorations of the sky at dawn and sunset are also important.

If the sky is pale or grey in the morning, or orange-red in the evening, fine weather will continue; brilliant colorations at dawn, almost always indicate rain. A yellow sky at sunset indicates wind, while when the disk of the sun appears to undergo certain characteristic deformations it is always a sure sign of rain.

Other chromatic indications, useful in forecasting, were recorded centuries ago as popular ideas based on experience, such as formed the subject of poetic treatment in Virgil's Georgics, and have been taken up recently, developed and propounded by Father PAOLONI of Montecassino, as an aid to weather forecasting under the title of "Virgil's Method". The observation of the higher air currents, determinable by observation of clouds (BESSON nephoscope) can also furnish useful indications for forecasting. If the wind below becomes stronger and the higher clouds travel in the opposite direction, or in a direction forming a fairly wide angle, it may be predicted that the wind below will give place to the higher current. Two winds succeeding each other in opposite directions almost always bring rain. In this respect, in winter, the case of the hot, very dry, South-East wind which is apt to blow on the Mediterranean Coast of Africa and which is invariably followed by a North-West wind bearing rain, is typical. Generally, rain may more easily be predicted, the more superimposed strata of clouds are present in the sky. Settled clouds in the direction whence the wind blows, only bring a continuation of the same air current; if on the other hand they appear in the

opposite direction, they announce the termination of it. When clouds collect from different directions, they indicate a thunderstorm ; clouds collecting on the slopes of a mountain indicate rain.

(4) Certain animals are able to give indications regarding change of weather : thus the behaviour of cats and birds on the approach of rain is known. On the approach of bad weather, flies become more troublesome and sea-birds come in greater numbers to the coast and fly lower. On the other hand, with fine weather, swallows fly higher, butterflies are more numerous, spiders weave their webs more actively, and flies fly even after the sun has set. Certain plants also can indicate the coming state of the weather and both in the case of animals and plants such behaviour is explained by variation of the hydrometric condition of the air when the change of weather is indicated.

(5) Since meteorological phenomena are always accompanied by more or less intense electrical manifestations, the importance in this respect of receivers of electric waves in wireless telegraphy is evident. The principle in itself, indeed, is not new, since in 1787 a priest, M. VENTAN of Burki (near Basle) had invented a kind of harp with 15 strings of different thickness, over 90 metres long, stretched on large cylinders and arranged at suitable distances from each other. The instrument (meteorological harp) was placed in a North to South direction and inclined so as to form an angle of 20°-30° with the horizontal. During changes of weather the harp gave vibrations of various strengths according to the distance and magnitude of the depression which it indicated. The receivers of wireless telegraphy can pick up the so-called atmospheric "parasites" or disturbances, the intensity of which is variable and at present classified in three categories — rustling, crackling, cracking. The crackings indicate the approach of a hurricane close to the station, e the crackings increase in intensity and frequency, it is retreating if they decrease. Slight rustlings, similar to the sound of frying, indicate the coming of a hail cloud, numerous cracklings, on the other hand, are indications of the occurrence of a large depression. If the isobars of the depression are concentric, the direction of maximum crackling will be that of the South and South-East sectors. Rain and mist make reception fairly good, the contrary is the case when the air is dry and cold.

A. FA.

151. **Forecasts of Stormy Squalls by means of Radio-Telegraphy.**

MUGNIER-SERAND J. Recherches en vue de la prévision des grains orageux en Afrique Orientale Française au moyen de la T. S. F. *Bullet. du Comité d'Études Hist. et Scient. de l'Afrique Occidentale Française*, No. 3, pp. 177-185 Paris, 1924.

At the station of Conakry (Gulf of Guinea) since 1919 and onwards M. MUGNIER-SERAND has undertaken a series of investigations with regard to the forecasting of stormy squalls, especially those which bring hail, by means of wireless telegraphy.

The first results obtained encouraged SERAND to renew his researches systematically in 1922, by making use of the apparatus on the antennae

and that on the radiogoniometric square. The object of the observations made on the square was to determine from the auscultation of "atmospheric parasites" perceived by help of the apparatus, the position of the storms and possibly to follow their course, determining also, as the storms gather, in what direction the parasites were most numerous. The apparatus used for this purpose consisted in the following parts.

Square with flat spiral of 1.45 m. × 1.45 m. 106 spirals about 8 mm. apart with a total length of 355 m. A 10/10 copper wire covered with two layers of cotton.

Plugs, dividing the roll into 5 parts. Condensor capable of being regulated by air 2/1000 m-d. Amplifier by resistance ; three valves one of which was detecting and compensating.

Listener of 2 thousand ohms.

This square was suspended at 1.80 m. from the floor inside a room with a roof of corrugated sheet iron.

The installation under the sheet iron was probably not the most favourable for the satisfactory reception of signals, but it was impossible to find on the hill (80 m. above the sea) any other more suitable place. Moreover, experiments made in the open air have shown that there was not an appreciable difference between signals received in this way and those obtained under the above-mentioned shelter. The brevity of the period of observation did not allow of conclusions being obtained; one fact, however, dominated the others, which was that except for a few rare exceptions, it was never possible to perceive a decided maximum of "parasites" in a determined direction. This is due to the fact that the observations were made at a time when there were almost daily formations of stormy squalls accompanied by an extraordinary abundance of atmospheric parasites.

It is on the other hand now proved that in French West Africa such parasites appear on a regular front of immense length, but with more or less marked sinuosity and with a general direction E-W.

From observations made with antennae during a longer period, M SERAND draws on the other hand the following conclusions : In Guinea, stormy formations are accompanied by a peculiar abundance of atmospheric parasites, a sort of preparation by electric artillery, a phenomenon which generally exhibits a fairly regular progression. After a certain time from the commencement of listening, the discharges are succeeded by a rhythmic noise which SERAND compares to that of frying, interrupted by periods of more distinct sparkings more or less prolonged. Taking into account the average velocity of stormy squalls estimated by HENRI HUBERT, at about 60 km. an hour, it is thus possible, with the installation described, to forecast the arrival of a storm 250-300 km. distant and therefore 5-6 hours before its arrival over the stations.

The following examples illustrates the progression of the sound of the "parasites" indicated : —

At 6 a.m. = 2 (index of sound) ; at. 9 a. m. = 2 ; at 2 p. m, = 4 (continuous sound); at 5.p.m. = 4 (discharges at intervals) ; at 5.30 arrival of the squall over the Station. This listening through wireless telegraphy enables, in a certain sense, weather pulse ta be felt.

Certainly the best solution for giving greater value to this method would be the employment of registers which would automatically record the atmospheric parasites, were it not for the fact that their use in restricted by the high cost. Undoubtedly, however, such apparatus and the direct observations indicated by it, may be a valuable factor, the use of which would tend progressively to become more common for forecasting weather in any given region and with great advantage especially to agriculture.

A. FA.

152. **Weather Conditions and the Yield of Almond Trees.**

EREDIA F. La previsione dell'entità del prodotto del mandorlo di un'annata in base all'andamento della temperatura dell'aria ed alle precipitazioni nel trimestre gennaio-marzo. *Rendiconti della R. Accademia nazionale dei Lincei*, Vol. I, ser. 6, half year 1, No. 9, pp. 548-552. Rome, 1925.

Variations in the yield of almonds are noted from year to year, sometimes so considerable as to affect the importance of the crop to a large degree. It is considered that a rapid fall in the temperature of the air and a succession of more or less intense frosts during the period when the almond trees begin to set their fruit, are the causes which more or less directly produce such variations, since in that case not all the small almonds, exposed to such conditions without protection, come to maturity.

More important than the sudden fall in temperature which has more influence than any other local conditions affecting the crop, are the general climatic conditions and for this reason the author has made investigations with respect to the general climatic conditions during the period from January to March in Apulia and Sicily, studying them with regard to the crop.

From the data collected, a relation has been shown between the thermal and pluviometric variations and the yield of the crop. Not only the falls of temperature in March have a decisive reaction on the value of the crop, but the whole course of minimum temperature and rainfall throughout the period from January to March also affect the crop. Uniform deviations in the minimum temperatures in the three months mentioned, in conjunction with not too heavy a rainfall, constitute the best conditions, which are less favourable when such uniformity is lacking and when, after a warm January, a cold February and March follow with heavy rainfall irregularly distributed over the region.

On the basis of the meteorological observations of the current year the author predicts that the crop will be approximately normal in Sicily; it will be slightly below normal in Apulia, because some species of almond tree were caught by falls in temperature while they were in full blossom.

A. F.

Fertilisers and other Products Useful to Agriculture.

153. **Investigations on Stable Manure.**

ZIELSTORFF and ZIMMERMANN H. (Agrikultur-Chemisches Institut der Universität Königsberg). Der Stalldünger, seine Aufbewahrung und Behand-

lung im Wirtschaftsbetriebe und sein Gehalt an wichtigen Pflanzennährstoffen unter heutigen Fütterungsverhältnissen. *Landwirtschaftliche Jahrbücher*, Vol. LXI, No. 2, pp. 236-283. Berlin, 1925.

The value of stable manure depends principally on the composition of the food given to the animals and on the method of storing and treatment of the manure. War conditions have brought about considerable changes in the feeding of cattle and consequently a decrease in the value of stable manure, a decrease which, in the case of Germany, was estimated in 1920 at 250 000 tons of nitrogen and 70 000 of phosphoric acid.

The object of this work is to define the present conditions and to estimate the present value of stable manure for application to the land. Peat is often used now as a litter, which entails a further decrease in manurial value.

The values found by the author are compared with those previously ascertained by other investigators. Thus we have for *stable manure*, estimating the dry matter at 25 %.

	P_2O_5	N	K_2O
STUTZER's values . .	0.350 %	0.700 %	0.800 %
HOLDEFLEISS' » .	0.270 %	0.543 %	0.666 %
The author's » . . .	0.200 %	0.538 %	0.662 %

STUTZER's values however, cannot be considered as average, but only as maxima ; on the other hand making the comparison with those of HOLDEFLEISS, which may be taken as corresponding to average conditions, it appears that there is at present in the case of stable manure a decrease of about 25 % in phosphoric acid, while nitrogen and potash may be taken as unchanged.

The following are the values for *sheep manure* on the 32 % of dry matter :—

	P_2O_5	N	K^2
STUTZER's values	0.250 %	0.850 %	0.070 %
The author's »	0.305 %	0 785 %	0.713 %

The higher values for phosphoric acid and potash are attributable to the fact that the manure was in a more advanced state of decomposition.

In the case of *manure heaps in the open*, the author obtained :—

P_2O_5. 0 232 % N. 0.449 % K_2O. 0.557 %,

which are all less than the lowest values given by STUTZER.

The author's researches indicate that in large farms the feeding of cattle is now much improved and that the manure is being properly stored ; the conditions on small farms, for which considerably lower values were obtained, are less favourable. The new system of treatment of manure by fermentation at high temperature is not yet common in Germany ; on the only farm visited by the author the required temperature was never attained.

Analyses of drainage effluents from horse stables have shown considerable differences, namely :—

for nitrogen from 0.11 to 9.92 gm. per litre, and potash from 0.43 to 17.87 gm., with prevalence of the lower values, so that more than half the

samples (55 %) contained less than 2 gm. of nitrogen and 5 gm. of potash per litre. The average values are 2.52 of nitrogen and 5.69 of potash, which are very similar to those of STUTZER who obtained 2.3 and 4.6. The proportion of K_2O/100 N. varies from 70 to 24.

The drainage effluent gave an average of 7.33 of potash and 3.57 of nitrogen; the proportion K_2O/100 N varied from 35 to 76.

The differences in the results vary considerably according to the size of the farm and to the various conditions of storage.

From the investigations recorded it may be concluded that the storage and treatment of manure still result in considerable loss which, so far as nitrogen is concerned, is capable of being much reduced by means of scientific treatment.

It should also be kept in view that, the present methods of feeding animals, results in a considerable decrease of phosphoric acid, while deficiency of protein in the feeding is not reflected in a corresponding decrease of nitrogen in the manure. The values for potash remain unchanged, or even, at least as regards the drainage effluent, seem to have slightly increased.

A. F.

154. **Sugar-Cane Trash as Manure.**

HARDY Prof. F. *Tropical Agriculture*, Vol. II, No. 6, pp. 121-122. Trinidad, 1925.

The investigations at Rothamsted have shown that micro-organisms, responsible for the breakdown of straw, cane-trash and similar vegetable matter that may be applied to the land, require nitrogen for their sustenance. Consequently, nitrogen in the form of urea in urine, or other compound, must be added before satisfactory cellulose fermentation can be obtained. If not added, the micro-organisms may draw on the nitrogen reserves of the soil, and this may lead to diminished crop yields.

Cereal growers have found that ploughing in fresh straw generally results in a depression in yield of the succeeding crop. The investigators at Rothamsted suggested that a leguminous crop should immediately follow the application of fresh straw, as that crop would be independent of nitrogen supply, and would provide sufficient nitrogen for the straw-decomposing organisms.

The action of straw chaff upon the development of root nodules of soya beans was studied, and a large increase of nodules was found to follow the addition of straw. However, the yield of the crop was not increased, because although the straw stimulated the infection of the roots with nodule organisms, it did not increase root growth.

Subsequently the combined action of straw and phosphate was tested, as it is well-known that phosphates stimulate root growth. The result was successful in preliminary trials and it is expected that a new system of manuring will be evolved, by which unrotted straw may be applied to the soil, followed by a leguminous crop manured with phosphates. In

this way nitrogen losses usually attendant upon the incorporation of cellulose material into soil may be overcome.

It is important that sugar-cane planters should take steps to conserve, or to build up the supply of organic matter in the soil, if serious deterioration in fertility is to be avoided. W. S. G.

155 **Guano-producing Birds.**

MURPHY R. C. (Amer. Museum of Natural History). The Most Valuable Bird in the World. *The National Geographic Magazine*, Vol XLVI, No. 3, pp. 278-302, 26 fig Washington, D. C., 1924.

If the advantages which various species of birds bring to humanity are expressed in hard cash, undoubtedly the first position belongs to those which produce guano and especially to the Peruvian cormorant, called "guanay", *Phalacrocorax bougainvillei*.

The *habitat* of this species is restricted to coastal waters of the arid western shores of South America between Punta Pariña, to the south of the Gulf of Guayaquil and Corral, in Chile. This stretch of coast, approximately 2 400 sea miles in length, is washed by a narrow oceanic current the Humboldt Current, which is considerably colder than the surrounding waters which have a temperature of 25-27°, while that of the current is about 15°. On account of the low temperature innumerable marine organisms live in the waters of the current, such as anchovies and other small fish which constitute the food of the Peruvian cormorant. They belong entirely to the Humboldt current, and move up and down the coast, following the fish, but never wandering beyond the limits of the current. The adjacent islands have the same desert character as the coast and to this fact is due the important economic character of the birds since their excrement has been accumulated on the islands without undergoing decomposition. Along the arid coast of Peru, where tempests are unknown, move dense flocks of guanays catching in their flight the fish which are nearest to the surface. At other times when the guanayes return to their nests from distant places where they have gone to get food, they fly in a dense unbroken stream which continues to pass for four or five hours.

The flocks, however, do not leave their nests without less ado in the morning. Some scouts go first who fly about here and there, rather high up, until their dropping and their divings indicate to the company left behind that the harvest may be good. The dense flocks than fly headlong and rapidly gorge themselves ; in a shot guanay, were found 76 anchovies 10-12 cm in length.

The guanay stands erect and walks like a penguin. It is about 50 cm. high and weighs a couple of kg. It has a glossy neck, green and blue-black and the back is also similar, while it is white in front ; during the pairing season a crest of feathers develops on the back of the head. The iris is brown, the eye is surrounded by an area of naked green skin. The feet are pink.

They live in very numerous colonies of about a million ; on the slopes, sheltered from the wind, of the Peruvian islands, the density is such that

PLATE XII

Fig. [illegible] Central Chincha Island

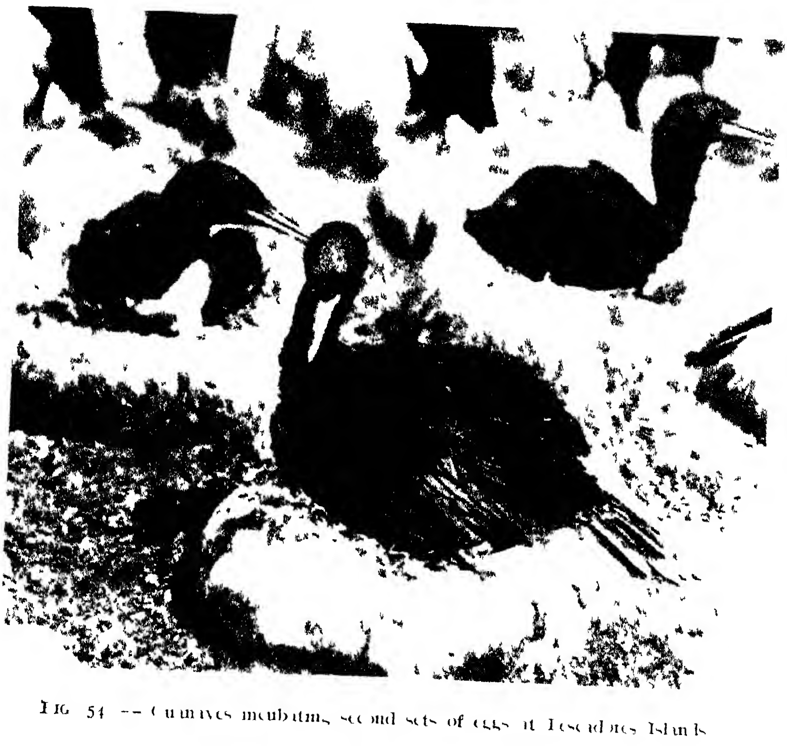

Fig. 54.—Guanayes incubating second sets of eggs at Pescadores Islands

there are three nests to every square metre of surface. Each pair rear a couple of broods a year.

They are not frightened by noise, not even of gun-fire, but rather by the sight of unaccustomed movements; they then fly away and the motion of the wings of so many birds produces a roaring comparable to that of a train in a tunnel. During their resting on an island, the guanayes are fouled with fresh guano, from which they clean themselves flying at a certain distance on the lee-side of the island. The enemies of the guanay are mainly vultures and condors which feed on the eggs which they sometimes destroy by thousands. The guanayes are also infested with parasites (Mallophaga) which however, do not cause serious harm.

The collection of guano is now regulated by the Peruvian Government, while for some tens of years it was so chaotic and unregulated that it had led to the exhaustion of the old deposit. It is now raised to the dignity of a real industry, centred in the National Guano Administration which has made a regular sanctuary of each of the bird islands, always closed to unauthorised visitors. For each group there is a competent guardian who resides on the spot; clandestine extraction of guano is strictly prohibited, as is also the stealing of eggs.

There is a technical management which has carried out important researches in meteorology, zoology and on the diseases of the guanay. Every island is subject to a kind of rotation by which the birds are assured of tranquility for their nests. Some ten years ago, the quantity of guano extracted annually was less than 25 000 tons, it now amounts to 90 000, of which 70 000 are used in Peru itself and the rest exported. These are low figures compared with the millions of tons which were shipped from ports in Peru during the last fifty years of last century. But the old abusive exploitation exhausted the ancient reserves to such a degree as to bring about such depletion that the guano was no longer even sufficient for local requirements With the new method, the colonies are repopulated and future production is assured. A. F.

156. **Field Investigations with Rhenania Phosphate.**

GISEVIUS Dr. and KLITOCH Asst. Dir. Felddungungsversuche mit Rhenania-Phosphat zu verschiedenen landwirtschaftliche Kulturpflanzen. *Deutsche Landwirtschaftliche Presse*, Year LII, No. 11, pp. 129-130. Berlin, 1925.

The "*Rhenania*" union of chemical works have produced since the war from chalk-phosphates and Eifel-Phonolites by crushing, mixing and drying in rotatory-furnaces, a phosphoric acid manure, which though containing originally only 12-14 % of P_2O_5, now contains as much as 25-30 % of "citrate-soluble" P_2O_5. This considerable increase has been brought about by a series of improvements in the methods of production. It should also be pointed out that "citrate-soluble" means the degree of solubility as determined for commercial purposes. Superphosphate contains "water-soluble", basic slag contains "citric acid-soluble" and Rhenania-phosphat contains "citrate soluble" P_2O_5. The latter also contains 30-40 % of lime, which gives it a basic character, and it also contains -.5 %

of pure potash. Being very finely crushed it mixes thoroughly with the soil, is very dry and does not decompose. It is thus a very valuable product, which on account of its chemical and physiological properties can be used regardless of the character and the reaction of the soil.

To investigate the practical results which might be obtained with this fertiliser, a series of experiments was undertaken in the years 1922-24 by the Agricultural Institute of the University of Giessen. These investigations were extended to very widely differing soils and climatic conditions and had for their object in the first place, to investigate the specific influence of Rhenania-phosphate itself, and secondly to compare its action with that of the two other P_2O_5 fertilisers on the same soil. For each investigation, there were 2-3 plots of ground, each of 100 sq. metres. Each plot received an adequate amount of N and K_2O manure and was tilled in the locally customary manner. The hoed crops received a fair or heavy farmyard manuring. The R.-Phosphate was applied *before* tilling (on the average of 18 % P_2O_5 content at 0.35 marks per kilo per cent.), in the following amounts: 3 quintals per hectare under corn at a cost of 18.90 marks, partly 3 partly 4 q. per hectare under hoed crops and grass at a cost of 25.20 marks. In the case of rye R.-Phosphate gave an increased yield of 268-442 kg. per hectare, which after deducting the above cost gave a net gain of a hectare The corresponding data for *spring-barley* and *oats* are:

Barley 238 kg -310 kg. corresponding to 35 40-51 96 marks.
Oats 506 kg. corresponding to 66.96. marks.

Decrease of the danger of storage, acceleration of development of the grain and of ripening, are a few of the effects of P_2O_5 manuring. In the presence of an excess of nitrogen it tends to prevent a too luxurious leaf growth.

In the case of kohl-rabi its use caused an increased yield of the value of 33.12 marks to 123 marks per hectare. In the case of potatoes it gave an increased yield of value 14.82 to 38.44 marks per hectare. It should be pointed out, however, that for hoed crops R.-Phosphate proved superior to the other two P_2O_5 manures for 50 % of the investigations, while in 25 % of the cases no comparisons were instituted, and in the other 25 % the superphosphate and basic slag were found to be better manures. But even in this case R.-Phosphate accelerated the ripening and increased the quantity of reserve material accumulated.

In the case of grass land R.-Phosphate also has a very beneficial influence especially on the Leguminosae, which supply N to the soil. In two different sections on 5 meadows the value of the hay gathered was increased by 7.80-19.42 marks per hectare by the use of R.-Phosphate, which shows a considerable gain. Also, the quality was improved.

Where it is the custom to apply farmyard manure every three years, the addition of P_2O_5 is of value. Rhenania-Phosphate, being a concentrated fertiliser, saves transport costs, and as it is suitable for all types of soil, is worthy of careful attention.

V. E.

157. **Field Experiments in Ireland in 1924.**

Journal of the Department of Lands and Agriculture, Vol. XXIV, No 4, pp. 424-439. Dublin, 1925

Details are given of field experiments carried out in Ireland during 1924, which included trials of phosphatic fertilisers, crop variety trials and experiments on the value of lime to a rotation of crops

"Peerless" basic phosphate, produced in Belgium, gave results equal to those of high grade slag in the case of crops, and on pasture produced earlier growth than any of the other forms of phosphate tested.

Of the mineral phosphates, Gafsa appears to be the most effective. A mixture of Gafsa and superphosphate in equal proportion is now on the market and contains about 45 % total phosphates.

The trials with varieties of wheat showed "Queen Wilhelmina" to be the most prolific winter wheat for general cultivation, but the variety is very susceptible to yellow rust. Yeoman wheat is superior in milling quality, strength of straw and rust resistance

The oat trials showed Victory II to be the most prolific variety, but as regards strength of straw and resistance to lodging it is inferior to Banner, Black Tartary 2, and Record. Black Bell III, a black oat, has proved to be very prolific, produces a long and fairly stiff straw and ripens early Both varieties are pure line selections from Svalöf

W. S. G.

158. **Effect on Nodule-Formation and Seed Production of Growing Soybeans on Soil treated with Sulphur Dioxide.**

LEONARD T. L. and NEWCOMER S H *Jnl. of American Society of Agronomy*, Vol 17, No. 6, pp 309-312. Geneva, N Y, 1925

Treatment of field soil with sulphur dioxide and formaldehyde in 1 % concentration showed that nodule formation was inhibited on the upper parts of the roots of Peking soybeans. "Sulphorm", a combination of the two above-mentioned substances, applied in the same concentration, did not inhibit nodule formation to the same extent.

No beneficial effects were noticed in the crops, except with Sulphorm, which gave 20 % more seed than the average of three controls.

W. S. G.

159. **The Action of Dilute Sulphuric Acid on Cornfields.**

RABATÉ E Action de l'acide sulfurique dilué dans les champs de céréales. *C. R. de l'Académie des sciences*, Vol 179, No. 22, pp 1285-1287, Paris, 1924.

Dilute sulphuric acid sprayed on the soil rapidly attacks the mineral constituents, producing sulphates which, in dry weather, appear on the soil as a white powder. It increases the hydrogen-ion concentration, but colloidal clay minimises the sharp variations of acidity. The action is energetic and results in an increased yield which will not fall off if the sprayings are made on dry soil, or during drought. On plants it has a de-

hydrating, but not toxic action, proportionately stronger when the plant is young and during dry, warm, bright weather.

Experiments have been made of spraying 1000 litres of 10 % solution of sulphuric acid of 65° Baumé, per hectare ; the sprayings were made in December-January in the warmer parts (Italy, Provence) and in March-April in the cooler areas (Touraine, Beauce). In these conditions various herbaceous plants are killed immediately (ranunculus, matricaria, medicago); others (poppy, vetches, vetchlings, cornflower) are only killed with a 12% solution ; some plants (rye-grass, wild oat, garlic, grape-hyacinths) are resistent to the treatment.

In fields of oats and spring barley, the application of a 4 % solution is sufficient to kill *sinapis* ; the time recommended for Central France is about the second fortnight of April.

Cereals with smooth erect leaves, covered with cutin, with the ears still covered, are slightly scorched and bleached by the acid, but eventually produce strong stems and full ears, slightly late in reaching maturity. Sulphuric acid is also useful against cuscuta, mosses, algae and especially against certain fungi, such as *Leptosphaeria herpotrichoides* and *Ophiobolus graminis*.

It is always advisable to make a preliminary experiment on a plot of ground in order to ascertain the most suitable dose ; the result is apparent in a few days.

A. F.

Agricultural Botany, Chemistry and Physiology of Plants.

160. **Bacteriophagi in the Nodules of Leguminous Plants.**

GERRETSEN F C, GRIJNS A, SACK J and SOHNGEN H L (Rijkslandbouwproefstation Groningen) Het voorkomen van een bacteriophag in de wortelknolletjes der Leguminosen *Verslagen van Landbouwkundige onderzoekingen der Rijkslandbouwproefstation*, No XXIX, pp 1-6, 3 fig The Hague, 1924.

Bacteriophagi have been isolated from the root nodules of clover, lupines and serradella ; this statement may explain the fact that inside such nodules the bacteria may disappear. These bacteriophagi appear to be specific in their action in respect to the bacteria which form the root nodules of the leguminous plants mentioned.

In addition to the nodules, the bacteriophagi have also been isolated from the roots and the stalk, but not from the leaves. They have also been isolated from garden soil and that of fields but not from that of woods and heaths.

These bacteriophagi withstand a temperature of 60° to 65° C. for 15 minutes, are resistant to drying and pass through thin collodion membranes. Their resistance to the ultra-violet rays is at least eight times greater than that of the relative bacteria.

A. F.

161. **The Age-Area Hypothesis in the Study of Flora.**

GREENMAN J. N. (Missouri Botanical Garden). *American Journal of Botany*, Vol. XII, No. 3, pp 189-193, 1 map. Lancaster Pa, 1925

The age-area hypothesis may have considerable importance in the study of flora, inasmuch as it simplifies many problems of botanical geography in the determination of the phylogenetic relations and in the evolution of groups of plants. This hypothesis assumes that the area occupied by a species depends on the age and, vice-versa, the age of a species is proportional to its geographical area. In other words, the area occupied in a given time, in a given country, by a group of allied species (not less than 10 in number) depends, principally – under approximately constant conditions — on the age of the species of this group in the country, such area however may become profoundly modified by the presence of barriers such as lakes, rivers, mountains, by changes of climate, by the action of man and by other ecological factors.

The present paper relates to the three divisions of the genus *Senecio*: Convolvuloideae, Streptothamni, Fruticosi. Each of these groups has a geographical distribution which, in South America, is extended in a continuous series in longitudinal direction (N-S). There has been a rapid migration northwards by these three groups, a migration which is extended along two lines towards Mexico and Cuba.

In the same group the species show a more or less definite relation between the area occupied and the age of the species themselves. This is evidenced by the greater stability of the morphological characters of the species which occupy large areas compared with those which are found over a limited area.

The species of the three groups considered are more or less woody; the greater part of them are of recent origin compared with other species of the same groups or with woody plants of allied groups. The origin of the respective species is not to be attributed to great changes but rather to natural selection which has been confirmed in the course of the relatively rapid migration northwards. Large and small changes may have occurred, but they constitute a factor of relatively small importance.

This article recognises that Willis' age-area hypothesis is fruitful and calculated to stimulate interest in the study of botanical geography.

A. F.

162. **The Problem of the Constitution of Starch.**

PHILIA M. Contributions au problème de l'amidon *Bull de la Société botanique de Genève*, II Ser., Vol. XVI, pp. 519-553. Geneva, 1924

The investigations of the author show that starches derived from various plants have different constitutions. If, by means of the iodine reaction, the process of depolymerisation with amylase of barley is followed, it is observed that the starches of *Solanum* and arrowroot give a rapid liquefaction with pure blue coloration, while rice and wheat starches give an old-rose or rose-purple coloration. In the former case there is up to

the end an excess of amylase which determines the permanence of the blue colour, while in the latter the preponderant amylo-pectin imposes its own specific colourability. This specific character is maintained if, instead of using the starch solution, the false solution of the corresponding so-called soluble starch is used, though in that case the amylo-pectin has disappeared. The specific colourability, in the second case, is not due to the possibility of providing a pectin (gelatin form), but to the existence of a fundamental aggregation of polysaccharides which are coloured rose-purple by the iodine It is also maintained by using reagents (lime, chloride of calcium, caustic soda, etc) which tend to bring about a tautomerisation of the polymerised colloidal complex masses.

If the chemists finally agree regarding the nature of the fundamental body, or bodies, which constitute the starches, the biologist must consider the manner and degree of polymerisation of the two categories:— amyloses and amylo-pectins which determine the specific character of the starches and of the substances which form the basis of such specific character.

The writer has also studied the phenomenon of the fixation of the amylase (AMBARD's phenomenon), in which the granules of starch mixed with a liquid containing amylase almost entirely fix the latter and the new complex: — crude starch + amylase — shows such stability that the ferment (defixation) cannot be regained without the recurrence of starch paste, glycogen or dextrin.

The author's experiments do not fully correspond with those of AMBARD, as the former only obtained partial fixation of the amylase. The starches, then, do not all behave in the same way; thus wheat and potato starches fix the amylase of barley, while those of rice, beans, arrow root, and barley do not fix it.

Various conditions, then, influence fixation, such as the concentration of the amylases, the reaction of the medium (an acid reaction is more favourable), the presence of phosphates and glycocoll (the former act in a more favourable sense than the latter)

An important observation is that fixation is checked by citrates and oxalates in the process of coagulation by enzymes.

A. F.

163. **The Significance of Copper, Manganese and Zinc in Forage Crops and Foods.**

MC HARGUE J. S. *Journal of American Society of Agronomy*, Vol. XVII, No. 6, pp 365-327. Geneva, N. Y., 1924.

The object of the article is to present data showing the occurrence and proportion of copper, iron, manganese and zinc in certain plant products and to draw attention to their significance.

Fertile soils contain small amounts of copper, manganese and zinc, which are absorbed to a slight extent by plants and stored in the leaves, pericarps and germs of the seeds. When maize, wheat and rice are highly milled, the resulting meal, flour and polished rice are deprived

of the greater part of the compounds of copper, iron, manganese and zinc, which appear to be factors in animal nutrition. Some depleted soils may require the addition of small amounts of copper, manganese and zinc in order to restore and maintain productivity and to produce a food supply containing the vital factors in normal proportion. W. S. G.

164. The Importance of Iron for Plants.

MARSH R P and SHIVE J W (New Jersey Agricultural Experiment Station) *The Botanical Gazette*, Vol LXXIX, No 1, pp 1-28, bibl, 2 fig Chicago, 1925

The work of the authors was done with the object of elucidating the relations between the iron content and the conditions of the plant (normal, chlorotic, toxic). A small quantity of iron, uniformly distributed, seems necessary for the health of the plant. The iron should be in the lowest concentration possible and scarcely greater than that which causes chlorosis owing to insufficiency of iron. When the concentration is greater, either toxicity is caused owing to the content being too high throughout the plant, or else chlorosis, because the iron is localised in the roots and stem and is unable to reach the leaves in sufficient concentration for the adequate formation of chlorophyll. To obtain a uniform distribution of the iron it is necessary to make frequent small additions, taking the state of the plant into consideration the addition of iron at stated intervals, previously arranged, is not recommended because the requirements of the plant in iron vary according to the stage of its development. The determination of the balance of iron is very delicate, inasmuch as the plant requires that the iron should be within very narrow limits of concentration in order to produce satisfactory growth. A. F.

165. The Constituents of the Sap of the Vine.

WORMALL A. (Department of Physiology and Biochemistry, Univ of Leeds). *The Biochemical Journal*, Vol XVIII, No 6, pp. 1187-1202, 1 fig, bibl London, 1924

The sap obtained from a vine which " weeps " is a dilute solution of organic and inorganic substances, containing 1.56 gm of solid matter per litre, of which about one-third is inorganic matter.

The organic constituents are principally :— sugars (glucose, fructose and a very small quantity of saccharose) and organic acids (oxalic, tartaric, malic and succinic) ; the amount of the latter exceeds that of the sugars.

The mineral salts consist of .— chlorides, sulphates, nitrites, nitrates, silicates and phosphates of sodium, potassium, calcium, iron, magnesium and, in smaller quantities, of manganese and aluminium.

A very small quantity only of organic nitrogen is found, probably contained in the enzymes ; the remainder of the nitrogen is in the form of nitrites and nitrates, though possibly there may also be some as amino-acids.

In the concentrated sap no trace can be found of lipin. A substance similar to fats was isolated, but in such a small quantity that it could not be identified ; it was probably a mixture of neutral fat and free fatty acid. In the sap enzymes were also found diastase, peroxidase, and a small quantity of catalase ; on the other hand, maltase, invertase, lipase, protease, glycerophosphates and renin were absent. A. F.

166. **Relation of Salt Concentration of Culture Solution to Transpiration and Root Respiration.**

NEWTON J. D. *Scientific Agriculture*, Vol. V, No. 10, pp. 318-320. Ottawa, 1925.

The author's experiments showed that the rate of plant root respiration, as related to transpiration, is increased when the salt concentration of the culture solution is increased. This indicates that as the concentration of the solution is increased, the plant must expend more energy in absorbing a given volume of solution.

The concentration of the soil solution is one of the factors governing water requirements of crops, and this concentration may be modified to some extent by cultural and manurial treatments. W. S. G.

167. **The Influence of Nitrites on the Growth of Plants.**

FEHÉR D and VÁGI I. (Botan Inst der Kgl ungar Hochschule in Sopron). Untersuchungen über die Einwirkung von Nitriten auf das Wachstum der Pflanze *Biochemische Zeitschrift*, Vol CLIII, No 1-2, pp 156-158 Berlin, 1924.

Some Hungarian alkaline soils contain a certain quantity of nitrites corresponding to 0.000 05 %. From the authors' researches, it appears that quantities even a thousand times greater are not prejudicial to vegetation, inasmuch as no toxic symptoms were observed four weeks after the addition of over one gramme of $NaNO_2$ for each kg. of soil.

The presence of traces of nitrites in soil can therefore have no influence on plant growth. A. F.

168. **The Effects of the Injection of Various Substances on Plants.**

NICOLAU G. " Actiunea injectarei diferitelor substante la plante ", *Buletinul Agriculturei*, Vol. IV, Nos. 10-12, pp. 67-80. Bucharest, October-December 1924.

The author gives an interesting account of experiments, made over four years, on plants in all stages of growth from March to October grown in experimental plots of the Agricultural College of Cluj (Transylvania).

Having studied the effects of numerous injections made in men and animals, the author's object was to ascertain the results of injections of various substances on plants.

Ten plants having swollen tubular stems and leaves, namely : —

Allium Cepa, Taraxacum officinale, Urtica dioica, Lamium album, Conium maculatum, Chairatus marrubiastrum, Sonchus arvensis, Cucurbita Pepo, etc., were chosen for the experiment.

The results obtained were that almost all the solutions were absorbed and circulated in the organism of the plant. Certain substances, such as glucose, were assimilated, by the plant, as food; other substances poisoned the plant, such as sulphates of copper, zinc, chloride of sodium, etc. The author points out that all depends on the dose and the concentration of the substance introduced, on its density and also on the age of the plant. For instance it has been found that nitrate of potassium injected into an onion plant or other plant, has a plasmolysing effect, while if injected in concentrated solution and in large doses, this salt has a toxic effect. The ions of copper have generally a toxic effect on plants, especially on adult plants, sulphate of zinc is also toxic. It was found by experiment that adult plants are a thousand times more resistant to poisoning with copper salts than is the case with germinating plants. Glucose, galactose and other sugars, not only have no toxic effect, but form suitable food material.

It was generally observed that the plants behaved absolutely like animals as regards the substances introduced into their organisms Only in the case when the solution acts in a reflex manner on the nervous system is the resistance of the plants to poisoning much greater than that of animals, plants being unprovided with a nervous system.

In conclusion the author shows that with the adoption of this experimental method in the vegetable kingdom, two benefits would result — one in the theoretical scientific field and the other in the field of practical application. From the former standpoint the author remarks — "I believe that plant physiology may obtain great benefit, because many phenomena may find new explanations. In agricultural science a number of capital questions may be cleared up by the application of this method, as, for example, that of "catalytic manuring" and mention is made in this connection of GABRIEL BERTRAND's experiments and theory.

L. L.

169. **Catalase in the Germination of Rice.**

MORINAGA TOSHITARO (Kyushu Imperial University Fukuoka). *The Botanical Gazette,* Vol LXXIX, No 1, pp 73-84, bibl Chicago, 1925.

The amount of catalase in dry rice is much less than that found in wheat, barley, oats, rye, of which, at most, it forms one tenth. When however rice germinates aërobically, an amount of catalase is found which is about seven tenths of that in wheat, barley, oats.

During anaërobic germination catalase does not increase, its formation is also reduced when germination takes place in a medium which contains a reduced amount of oxygen; it is inferred therefore that the proportionate increase of catalase activity is a function of the free oxygen in the medium. The free oxygen acts directly and indirectly on the development of the plumule and the radicle and also on the chlorophyll.

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The seedlings which have grown aërobically and contain much catalase, consume greater quantities of oxygen than those which are grown anaërobically with low catalase activity. The latter give off a relatively larger amount of carbonic acid gas. A. F.

170. **Hydrogen-Ion Concentration and the Development of the Pollen Tubes of *Lathyrus odoratus*.**

BRINKS R. A. (Agricultural Experiment Station, University of Wisconsin). *American Journal of Botany*, Vol XII, No. 3, pp 149-162, 4 fig, bibl Lancaster, Pa, 1925

It is known that pollen can germinate in artificial conditions on agar containing sterile saccharose and saccharomycetes.

In such circumstances, it is observed that the nuclei are situated in such a position that fertilisation may take place. These observations have particular importance because, the first factors of sexual reproduction being known, it may be hoped to arrive at a better knowledge of the process of reproduction and thus of certain problems relating to genetics. In his experiments, the author has taken care to prevent the toxic effect of the cations K and Na, which are introduced into the growth in the adjustment of the P_H. The maximum germination percentage is obtained with P_H 7.0, although the percentages obtained with P_H 6.0 and 8.0 are not much lower. It seems probable that, within these limits, the optimum hydrogen-ion concentration for germination is not clearly fixed.

The P_H zone favourable for the development of the pollen tubes, is relatively narrow. The optimum is about 6.0, while above and below that point development decreases rapidly. It should be emphasised that for germination there is considerable tolerance with regard to pH, while for subsequent development there is a restricted tolerance. It is not improbable that the hydrogen-ion concentration may modify the development of the pollen-tubes by a direct effect on the chemical reactions connected with the digestion of reserve materials.

In these experiments, the author has noted that, even when the known variables are accurately controlled, variations in the germination and in the development of the pollen are so considerable that it is necessary to make use of great numbers and to repeat the experiments in order to represent the facts statistically with a close approximation to accuracy.
A. F.

Plant Genetics.

171. **Crossings of Varieties of Maize.**

KOCH L. and SCHREUDER W. Vergelijnksproef van Maisbastaarden. Extract from *Algemeen Landbouwweekblad voor Nederl.-Indië*, 1. halfyear, pp. 2-11. Bandoeng, 1924

Crossings of three varieties of maize (Saipan Corn, Yellow Menado and White St. Croix) have given favourable results; crosses were made between the first and each of the other two.

The yield of grain exceeded by 40-50 % that of the parents; there was less tendency to lodging; a larger yield of leaves and stalks was obtained; the seed is less subject to mould (*Aspergillus* sp.). A. F.

172. **The Division of the Root and the Production of Seed in the Turnip.**

PASSERINI N Sopra la influenza della divisione della radice di « Brassica rapa L » sulla produzione del seme *Bollettino della Società botanica italiana*, No. I, pp 6-10 Florence, 1925

Division of the root was, together with grafting and multiplication by buds, adopted with the object of increasing the production of seed in selected varieties of sugar beet

The author has made similar experiments, observing that mutilation of the roots caused the loss of a certain number of individuals, a loss which became greatest (over $^1/_5$) with the division of the roots into four quarters. The *total weight* of seed produced on three experimental plots, in which had been placed entire roots, roots cut in two and roots cut in four, remained approximately equal, which shows that division would have caused an increase if the serious mutilation had not occasioned the loss of about $^1/_5$ of the plants

Mutilation considerably lowered the average yield per unit production of seed of plants thus grown and rather more with division in four than with division in two Notwithstanding this, the production of seed in some cases exceeded the average of plants grown in normal conditions and actually in 13 % of the plants divided in two and in 4 % of those divided in four. Mutilation was likewise the cause of lowering the average weight of the seeds, which was proportionally greater according to the degree of mutilation. A. F.

173. **The Chromosomes in *Saccharum*.**

BREMER G (Plantkundige aan het proefstation) De chromosomen bij primitieve vormen van het geslacht Saccharum *Archief voor de suikerindustrie in Nerderlandsch-Indië*, No 16, pp 477-508, 20 figs Soerabaya, 1924

In the Andropogoneae and in the Maydeae the chromosomes are 10 in number or a multiple of 10 and also in the genus *Saccharum* they are often found as a multiple of 10.

It is probable that originally the number of chromosomes in this genus was 10 and that from it have been derived the present species with a larger number of chromosomes. A. F.

174. **Report on Five New Hybrid Varieties of Tobacco.**

GUTIERREZ M. E. *Philippine Agricultural Review*, Vol. XVII, pp. 263-260, plates 6. Manila, 1924.

The object of the hybridisation work was to obtain a combination of desirable wrapper leaf characters by crossing the Pikit Station

varieties with introduced varieties. The five hybrids obtained have advantages over their parents in luxuriance, vigor, earliness, size of leaf and rapidity of growth.

The author supplies botanical details of each hybrid. The article is illustrated by excellent photographic reproductions. W. S. G.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES

(INCLUDING FORESTRY).

175. Influence of Spacing between Plants on the Yield of Maize.

SCHREUDER W. Uitkomsten van een plantverbandproef met gele Menado mais. Extract from *Algemeen Landbouwweekblad voor Nederd.-Indie*, 1 half-year, pp 1-9. Bandoeng, 1924.

Experiments in spacing made by sowing the "Menado" variety of maize in furrows 3 feet apart and at distances respectively of 3, 2 ½, 2, 1 ½ feet. The spacing 3 ft. × 2 ft. gave the best results, as regards dry grain, in proportion to area. The yield of dry grain for each stool was proportionally greater with the wider spacing of the plants. The total number of stools per unit of area was of course greater with the narrower spacing, but the average weight of each plant, was, on the contrary, proportionally less. With the wider spacings the stems each formed two or even three tillers; with spacings narrower than 2 ½ feet each stem formed only one tiller. As a rule the *Menado* variety has only one tiller, but may have more under good conditions. With spacings narrower than 2 feet the plants lodged. A. F.

176. A Valuable Swamp Grass.

AUDAS J. W. *Journal of the Department of Agriculture*, Victoria, Vol. XXIII, Part. 6, pp. 366-369. Melbourne, 1925.

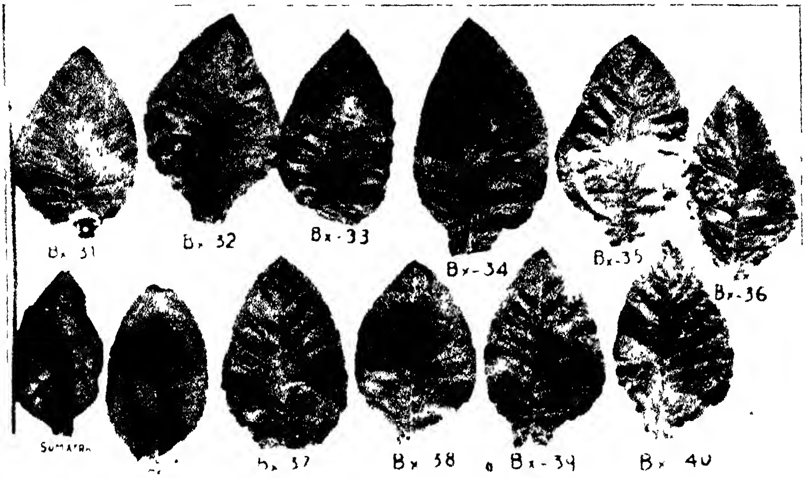
Indigenous swamp plants are generally of low nutritive value, and certain grasses that have been introduced to replace them have not proved strong enough to overcome the local growth.

The plant *Glyceria aquatica*, Wahlemb, "Water Spear Grass or Reed Meadow Grass", however, has been tried in various parts of Australia, with satisfactory results.

Fodder may be obtained from these plants during eight or nine months of the year, and as much as 50 tons of green fodder per acre have been cut.

As regards protein contents, *Glyceria aquatica* contains 7.67 %, as compared with Japanese Millet 6.43 %, and *Paspalum dilatatum* 6.31 %. The grass is relished by all kinds of stock. W. S. G.

PLATE XIII.



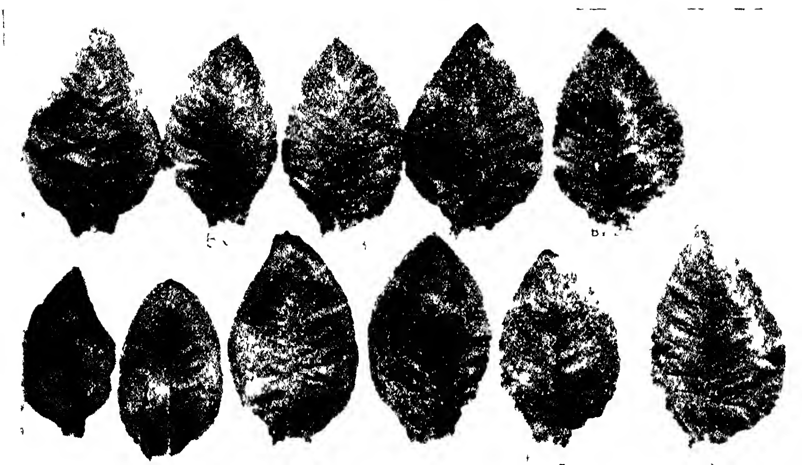


FIG. 55 and 56.—Shapes of leaves of the different strains of the Florida-Sumatra Baker's Sumatra.

177. **Production of Long Stapled Cotton in India.**

KOTTUR G. L. (Cotton Breeder, Dharwar). *Agricultural Journal of India*, Vol. XX, Part III, pp. 195-199. Calcutta, 1925.

There is a great shortage of long stapled cotton, and an increase of 100,000 bales of this type is more important to the world than 1,000,000 bales of short stapled cotton below $^7/_8$ inch.

The great bulk of the Indian crop is of decidedly short staple, and the Indian mills consume nearly 80 % of the good cotton produced.

Kumpta cotton, of medium staple, gives only 25 % of lint on ginning, but was found to contain higher ginning strains, and by isolating one of them, the percentage has been raised to 28 %, an important increase in yield obtained without change in any methods of cultivation.

Two pure strains, were crossed, one of Kumpta with a ginning percentage of 28 and a long staple (1 inch), and another of *neglectum rosea* with a ginning percentage of 36 and a staple of ½ inch. After five years selection pure strains have been obtained combining the desired characters of both parents ; the strains will shortly be issued to replace Kumpta cotton.

In all probability, a staple of one inch is the limit for Indian cottons, and the ideal should be to breed types with a ginning percentage of 45 and a staple of 1 inch, suitable for cultivation in different areas.

The Dharwar-American cotton contains both hairy and glabrous plants ; by isolating a superior strain of the hairy type, the yield and quality have been improved and the cultivation area extended. Cambodia cotton was at one time yielding cotton of staple longer than one inch.

The author is of opinion that the breeding of American cotton has good prospects for the production of long staple.

First generation hybrids are often very profitable, a cross between Dharwar-American and Sea-Island produced the same quantity of lint as the former, but of the Sea-Island quality. The chief difficulty, however, is to obtain sufficient seed every year for sowing.

Tree cotton produces long staple, and there is a considerable area of the heavy rainfall tract of Bombay suitable for this type, but tree cottons cross freely in the field and pure seed is very difficult to obtain. The first generation hybrid between two pure varieties such as Kidney and Peruvian is profitable. W. S. G.

178. **Tanning Materials from Travancore.**

Bulletin of the Imperial Institute, Vol. XXIII, No. 2, pp. 158-168. London, 1925.

The following barks were forwarded for investigation —

(1) " Elengi " (*Mimusops Elengi*, Linn.) ;
(2) " Perzhu " (*Careya arborea*, Roxb.) ;
(3) " Mora " or " Munga Perzhu " (*Buchanania latifolia*, Roxb.) ;
(4) " Vaga " (*Albizzia Lebbek*, Benth.) ;
(5) " Karlencha " (*Acacia pennata*, Willd.) ;

(6) " Thambagom " (*Hopea parviflora,* Bedd.) ;
(7) " Venga " (*Pterocarpus Marsupium,* Roxb) ;
(8) " Thembavu " (*Terminalia tomentosa,* Bedd.).

The results of the investigation showed that none of the eight samples represented bark which could be profitably exported to Europe as a tanning material.

Although containing too little tannin to be worth exporting, the *Hopea parviflora* bark (No. 6) is a promising material for extract manufacture, and should yield a solid extract containing 50 % of tannin. *Terminalia tomentosa* bark (No 8) should yield a product similar in quality to mangrove extract. W. S. G.

179. **Lac in Indo-China.**

CREVOST Ch. " Catalogue des Produits de l'Indochine ", *Bulletin économique de l'Indochine,* Year XXVIII, 1925-II, No. 171, pp. 191-205, 3 fig. Hanoi, 1925.

The author continuing the publication of the " Catalogue of the Products of Indo-China " deals here with stick-lac in Indo-China.

The area of production of stick-lac is very extensive ; the principal centres of production are as follows. —

In Tonkin, the provinces of Son-la (Châus of Son-la, May-son) and Hoa-binh (districts of Van-yên and Van-bu), the 4th Military district (Chaus of Lai-châu ; Luan-châu , Diên-biên-Phu ; Tuan-giao) ; Cho-ho is the principal market. In North Annam, the high regions of Nghê-an and Thanh-hoa backing on the Laos frontiers. In Laos, the provinces of Houa-Phans (Munnga of Samneua, Muong-het, Sam-teu, Muong-son), Tranninh, Vien-tiane, Haut-Mékong (Ban-houei-sai), Saravane, Bassac (Khong), Strung-treng, ,etc. In Cambodia, the regions of Kompong-speu, Kompong-thom, Pursat, Takeo, Khets of Treang, Bati, Preykrebas.

In Cochin-China, the province of Tagninh, to a small extent, and the provinces of Rach-gia and Soc-trang with a crop of some importance recently started. The plants on which the colonies of *Tachardia lacca* R. Bld. live are very numerous and belong to various families, some laticiferous, others without secretions.

It is claimed that the products are different according to the trees on which the insects live, altough there may be various species.

A distinction should be made between plants cultivated as lac-bearers and species forming naturally hosts for the *Tachardia,* both of which yield two annual crops, the first in September and October, the more important, and the second less in quantity, in March and April, limited by conditions of altitude.

The plants cultivated as lac-bearers are as follows : — *Cajanus indicus* Spreng. — *Combretum quadrangulare* Kurz. — *Dalbergia nigrescens* Kurz. — *D. Kerrii* Craib. — *D. hupeana* var. *laccifera* Eberhardt and Dubard. — *Schleichera trijuga* Wild. — " Pik-nieng " (undetermined species of Laos). Wild plants naturally lac-bearers are as follows. — *Ficus religiosa* L. — *F indica* L. — *Butea frondosa* Roxb. — *Shorea cochinchinensis* Pierre. — *Feronia elephantum* Corr. — *Nephelium Litchi* Camb.

The author deals with the swarming and the crop, then with the industry of the product. The natives of Indo-China seldom make use of stick-lac now. Before the introduction of aniline dyes they used the colouring matter " Lac-dye " for dyeing materials red or violet with a mixture of indigo. They continue to use only small quantities of stick-lac in conjunction with other materials for lacquering teeth, for fixing tools in their sockets and for preserving farming implements against rust a layer of stick-lac being applied hot. Indo-Chinese stick-lac is therefore exported outside the Colony. The trade exports are as follows :—

(1) Through Haiphong (Tonkin) for Tonkinese production and that of North Laos.

(2) Through Saigon (Cochin-China) for Cambodian production and that of South Laos.

(3) Through various ports of Annam for the production of Annam and the neighbouring lac producing regions.

The following statement shows the figures of stick-lac exports from 1914 to 1924 :—

1914	206,500 kg.
1915	64,600
1916	135.200
1917	95,500
1918	84,200
1919	762,800
1920	955,800
1921	444.700
1922	1,232,100
1923	1,177,100
1924	6,347,500
Total	6,347,500 kg.
Average	577,000 kg.

The distribution of exports for the year 1924 was :—

Cochin-China	636,600 kg.
Tonkin	544,600
Cambodia direct	4,800
	1,186,000 kg.

In addition, as the result of a refining process, the following quantities of " shell-lac " have been exported through Tonkin :—

1917	3,000 kg.
1918	—
1919	200
1920	—
1921	—
1922	1,200
1923	5,800

Lastly, Cochin-China has been able to export the following quantities of shell-lac: —

1920	29,500 kg.
1921	10,000
1922	—
1923	23,500 kg.

At Hanoi the market price for stick-lac in July 1924 was 100$ per 100 Kg.

At Saigon, at the same date, stick-lac was quoted at between 120 and 140$ per 100 kg. P. C.

(*Correspondent Indo-China*).

180. **Manuring of *Hevea brasiliensis*.**

SPRING F. G. *Malayan Agricultural Journal*, Vol XIII, No. 5, pp. 145-145. Kuala Lumpur, 1925.

A system of manuring for annual crops is easily determined, but such is not the case with permanent crops like rubber, where the influence of fertilisers on later yield is still problematical.

The high temperature, humidity or heavy rainfall of Malaya, cause more rapid decomposition of substances in the soil than occurs in temperate zones and plant food is rendered more rapidly available.

Attention is drawn to the work of other investigators, and to experiments carried out in Ceylon, Malaya, South India and Sumatra, the results of which do not indicate that the application of artificial fertilisers will be an economic proposition in respect of increased yields of latex, except under certain circumstances. W. S. G.

181. **Anomalies in Sugar Beet.**

MORI G. Anomalie riscontrate sulle bietole da zuchero coltivate nel 1924. A pamphlet of 22 pages, with 13 fig Genoa, 1925.

Beet growing in 1924 was characterised by the rainy conditions of the summer, low temperatures and by the consequent abundant but poor quality yield. Among the anomalies frequently noticed may be mentioned the "colletto ad ananasso" (French "*cul de bœuf*"), caused by various unfavourable circumstances, such as: —

(1) prolonged coldness of the soil and excess of moisture;

(2) uneven distribution of the plants and especially isolated plants which have in consequence abnormal growth;

(3) intense attack by *Cercospora* favoured also by late sowing and the consequent immaturity of the roots and foliage.

Another anomaly frequently observed was the strong development of surface roots and the production of rootlets. This result is partly due to the humidity of the soil and also to badly executed thinning of the beet plants. Everything should be done to prevent the formation of these

surface roots, which give a very inferior product, a large proportion of which will be thrown away before it reaches the factory. It will also be necessary for manufacturers and growers to come to an agreement in order to avoid the first losses due to an inferior product and they should therefore arrange for a minimum diameter of the roots; such a limit has been fixed in some cases at 10 mm., so that roots which pass through a 10 mm. ring are considered as rejected.

A. F.

182. **The Relation between Spacing and the Yield of Sugar Cane.**

LOHR P. L. Het verband tusschen uitstoeling en rietproduct *Archief voor de suikerindustrie in Nederlandsch-Indie*, Year 32, No 31, pp 767 773. Soerabaja, 1924 — TENGWALL, T. A. *Idem, Ibidem*, pp 773-786.

From experiments made in the open field, LOHR concludes that with diminished spacing between each cane plant the total weight per *bouw* (= 0.7096 ha.) is increased, though the weight of single canes generally is less. The influence of the spacing, in the same field and for the same variety of cane, is preponderant in relation to the yield in that plantation.

TENGWALL, on the basis of mathematical considerations, shows that no direct relation exists between the spacing and the weight of the cane since the weight of single canes also has an influence on the product. LOHR's conclusions do not admit of a generalisation which might lead to erroneous statements

A. F.

183. **The Burning of Sugar Cane to Facilitate Harvesting.**

CROSS Dr. W. E. (Director, Agric Exp Station, Tucuman), *The Planter and Sugar Manufacturer*, Vol LXXIV, No 16, pp. 305-310, tables 4. New Orleans, La., 1925

The burning of cane before harvesting leaves the stalks free from leaves and reduces the cost, as a labourer in Hawaii can cut three tons more per day than when the canes have to be stripped by hand.

The stalk is not burned, but the cells, and therefore the cane, is killed, and the cane in consequence is liable to decomposition. GEERLIGS found that if the burnt canes are milled at once, the juice is not much inferior to that of unburnt canes.

Results of experiments have shown definitely that the burnt cane is of good sucrose content and purity if harvested and milled within two or three days of burning; hence, the area burned should not exceed what can be cut and milled within the above period.

Investigations are being continued at the Tucuman Station as deterioration is found to proceed slowly, as compared with results reported from tropical countries.

W. S. G.

184. **Quality of Cacao.**

WATTS Sir FRANCIS K C. M G., D. Sc *Tropical Agriculture*, Vol. II, No. 8, pp. 172-174. Trinidad, 1925.

The qualities desired by manufacturers of cocoa or chocolate are plumpness of beans, readiness to fracture, good colour of interior of bean, a cinnamon colour being preferred to purple or dark colours, pleasant taste and aroma, and freedom from excessive bitterness.

It should be possible to modify the quality of the cacao by different methods of fermentation and drying, but certain varieties of cacao possess distinctive characteristics, and these are sought after by manufactures for specific purposes.

The lowest grade variety is the Calabacillo cacao, whose beans are harsh in flavour and not suited for fine grades of cocoa or chocolate The next grade is the Forastero cacao, which forms the main supply of the market; it has a more delicate flavour and is less harsh and bitter than Calabacillo. The most delicate flavoured is the Criollo variety, a native of Venezuela and the neighbouring parts of South America, and this cacao constitutes the standard for high quality cacao. The beans are round and the interior white, the flavour is delicate and free from bitterness. Unfortunately the tree is more delicate and susceptible to disease than either of the other types.

The introduction of the Criollo variety into other countries presents difficulties, as it has been found that cross pollination takes place with local varieties, with the result that the hybrids gradually revert to the local type.

To establish Criollo plantations successfully it would be necessary to proceed on a "community basis," as has been done in the case of pure strains of cotton. Only the one variety must be grown in a given district. To attain this object, legislative action would be necessary to prevent the planting of any other type than Criollo, and the destruction of trees of other types already in existence.

In Ecuador three varieties are grown, Arriba, Machala and Varanjal, all of which possess desirable and valuable aromatic flavours and are high grade cacaos. They are not grown in Trinidad on account of the danger of introducing certain diseases known to occur in Ecuador.

W. S. G.

185. **Growing Wrapper Tobacco in the Cotabato Valley, Mindanao.**

GUTIERREZ M. E. Superintendent, Pikit Tobacco Station. *Philippine Agricultural Review*, Vol. XVII, No. 4, pp. 227-236. Manila, 1924.

The author describes the climate, soil and methods of cultivation and handling of tobacco, employed in the Cotabato Valley, and then summarises the requisites for the successful production of wrapper tobacco, as follows :—

(1) A very rapid uninterrupted growth of the plants.

(2) Uniform stand of the crop in the field in order to provide the necessary intershading of the leaves.

(3) Planting at close distances for production of fine leaves.

(4) Absence of spots and specks caused by diseases and damage by worms and insects.

(5) Proper curing, and fermentation controlled by the thermometer.

(6) Careful classification of leaves into classes and grade.

(7) Careful attention to all details incident to production.

W. S. G.

186. **Banana Cultivation.**

DASH Prof. S. J. *Tropical Agriculture*, Vol II, Nos. 7, pp 144-147, No. 8, pp. 184-185 Trinidad, 1925.

The article covers the more important points of banana cultivation, the subject being treated under the following heads: History and commerce, botanical relationship and structure, varieties, soils and climate, propagation, preparation of land, time to plant and prune, after-treatment of land, harvesting, pests and diseases, returns.

The following figures relate to banana cultivation in Grenada: estimated cost over a three years period of cultivation, harvesting and transport, £ 42 per acre, which with an average yield of 750 bunches in the three years, at 2s. per bunch, give a gross return of £ 33 or £ 11 per acre per annum. W. S. G.

187. **Forest Fire Protection.**

TROUP Prof. R. S (Director, Imperial Forestry Institute, Oxford). *Tropical Agriculture*, Vol II, No. 8. pp 167-169 Trinidad, 1925

In the paper the author indicates some of the more important points connected with forest fire protection; the actual measures to be adopted in individual cases must depend on local conditions.

Forest fires constitute so great a menace to the welfare of the forest that fire protection may be regarded as an essential preliminary to successful forest management. In the great coniferous forests of British Columbia it has been said that for every tree utilised more than 20 trees are destroyed by fire.

Attention is drawn to the value of fire maps, which are useful for noting the increase or decrease of fires over a number of years, and also for showing in what parts of the forest they occur. In parts of North America and India, fire maps have shown that forest fires have originated most frequently near farms and village lands, which information is of use in indicating control measures. W. S. G.

ZOOTECHNICS.

188. The Partial Replacement of Hay by other Foods.

DE RUYTER DE WILDT J C and BROUWER, E (Rijkslandbouwproefstation Hoorn) Onderzoek omtient een gedeeltelijke vervangin van hooi door andere voedermiddelen *Verslagen van landbouwkundige onderzoekingen der Rijkslandbouwproefstation*, No XXIX, pp 61-93, I fig. The Hague, 1924.

The authors have tested the effect of replacing about $^2/_3$ of the ration of hay by a mixed food of composed " Tarwegrint " (a milling by-product similar to bran) and maize meal with pea and oat straw The test was made on the milk production of dairy cows.

The result of such replacement in a mixed diet was that no influence could be noticed either on the weight of the cows or on the quantity and composition of the milk. From calculations made, it is concluded that in the winter of 1922-1923, in a period of scarcity of hay, the above replacement caused a saving of 135 florins per 1000 kg of live weight in a stall period of 180 days A F.

189. Seconds Bran for Feeding Pigs.

BRUWER E (Rijkslandbouwproefstation Hoorn) Vergelijkend onderzoek omtrent de voederwaarde van tarwegries en tarwegrint bij varkens *Verslagen van landbouwkundige onderzoekingen der Rijkslandbouwproefstation*, No XXIX, pp 12-48 The Hague, 1924

" Tarwegries " and " Tarwegrint " are by-products of fine milling of grain which may be considered as bran, or seconds. The percentage analysis is as follows: —

	Tarwegries	Tarwegrint
Crude protein	18.0	14.2
Pure protein	16.1	13.0
Pure digestible albumen	11.7	11.4
Nitrogen-free extract	51.6	50.7
Crude fat	4.8	3.9
Crude cellulose	7.7	10.8
Ash	4.5	5.2
Moisture	13.5	15.2

These products are not much liked by pigs. Their nutritive value, as appears from the writer's experiments, in less than that of barley or maize. A. F.

190. Report on Comparative Experiments with Pigs from State-aided Pig Breeding Centres.

LUND A., BECK N., ROSTINF P. — 13de Beretning om sammenlingneude Forsøg med Svin fra statsunderstøttede Avlscentre. 117de *Beretning fra For-*

søgslaboratoriet, udgivet af den Kgl. Veterinaer-og Landbohøjskoles Laboratorium for landøkonomiske Forsøg, pp. 1 36, plates, bibliography. Published by AUGUST BANG, Copenhagen, 1925.

The report describes investigations made during the period September, 1st 1923 to August, 31st 1924 at the three *Pig Experimental Stations : Bregentved, Elsesminde*, and *Over-Løjstrup*, the purpose of which was to study the fattening and butchering qualities of the pigs coming from the State-aided centres and fed at the stations

In Denmark we find practically two breeds of pigs only , the Danish Country Breed and the Yorkshire Breed (the Large White). There are a number of breeding centres for each of these races in Denmark, the purpose of which is to produce pure-bred animals. The foundation of the centres, which goes back more than 30 years, is chiefly due to the influence of the Live-stock Commissioner, M. P. Mørkeberg.

The original reason for starting these centres was that Denmark almost forty years ago began to sell bacon to England. The type of pork existing in this country at the time did not possess the qualities demanded by the English bacon market, and to meet this difficulty, a search was made throughout the country for animals of the type in request. These animals were then brought to the *Breeding Centres*, which were in course of time able to distribute good breeding animals all over the country. The fact was, however, that a large percentage of the country bred pigs — at that time at any rate — suffered from such essential deficiencies (form, fineness) that it was much to be desired that breeding animals of better form should be used for breeding animals for the market. Consequently Yorkshire Breed centres were founded for producing boars, so as to procure — by crossing them with country sows — the real bacon pigs. As a far greater number of sows than of boars are required for breeding a considerably greater number of centres were established for the native breed than for the Yorkshire breed. The reason for not breeding exclusively from the Yorkshire is that this breed is considered to be too delicate for the Danish conditions. At present there are in Denmark 161 centres for the native breed and 33 for the Yorkshire breed. The centres must submit to an inspection on the part of the management, who select the animals fit for breeding, the centres obtain a very modest annual subsidy from the Government, and in return bind themselves to keep the necessary herd-books, mark the animals and deliver to the experiment station of the district two pigs every year of the sows chosen. In the course of the years (until the 1st of September 1924) a very great number of breeding animals came from the centres; 27 800 boars and 65 654 sows of the country breed, 10 237 boars and 4 478 sows of the Yorkshire breed were sold.

In estimating the value of the breeding animals selected, especially as regards the fattening and butchering qualities, great assistance is afforded by the figures from the experiment stations. It has been mentioned that the centres are bound to forward to these stations two pigs for each sow chosen ; this is done by each separate centre for-

warding — after the best boars and sows — a certain number every year of *experimental batches*, consisting of 4 porkers, 6-8 weeks of age, of the same farrow and preferably 2 boars and 2 sow-pigs. Each of the stations, which are spread all over the country, may breed from 100-200 experimental batches every year. The same mode of proceeding is applied everywhere, only certain kinds of grain (barley, oats, wheat in proportion ½-¼-¼) and skim milk being used for feed. The feed is weighed out every day for each batch that has its own sty at the station ; every fortnight each pig is weighed and when the fattening is ended (the pigs on leaving have a live-weight of fully 90 kg.) the consumption of food which for each individual batch has been necessary to produce on an average 1 kg. of growth, is estimated in food units. The sufficiently fattened animals are taken to the slaughter-house and after the slaughtering, each animal is submitted to a competent judgement at which various measurements are taken (the depth of the belly, the length of the trunk) and marks are given for characteristics of form, fineness, fleshiness, etc. For 1923-24 the reports from the three experiment stations show the averages given in the table :

Averages for the Experiment Stations for the year 1923-24.

		Native Breed	Yorkshire Breed
Number of animals		1192	312
Age in days	at the beginning	60	63
	» » end	184	194
Weight in kilos	at the beginning	16.8	15.9
	» » end	92.1	91.6
Food units (kgs.) for 1 kg. growth during the time of the experiment		3.59	3.55
At the time of slaughtering	percentage of waste	26.9	25.4
	» » offals	12.6	12.6
	» » bacon for export	60.5	62.0
Thickness of the pork in cm.	the chine	4.2	4.1
	» belly	2.9	3.2
Length of trunk in cm from hip-joint socket to neck		89.5	88.2
Points in (x) judging 0 – 15	firmness of the pork	12.6	13.5
	thickness & evenness of the chine of pork	12.4	12.5
	thickness and fleshiness of the belly	11.5	12.2
	shape and size of the hams	11.9	12.4
	fineness of head, legs and skin	12.4	13.1
	fleshiness	12.2	12.4

(x) 15 = vg, 12 = mg, 9 = g.

The country bred pigs reached the slaughtering weight ten days before the Yorkshire pigs; the ratio of fatness f. u. to 1 kg. growth was excellent and alike for both breeds. The native breed was a little longer in the trunk, but as to quantity of export bacon and quality, the Yorkshire breed appears to be superior.

FARM ENGINEERING.

191. Experiments in Electro-Culture.

SMITH, F. Beretning om tre aars elektrokulturforsøk. *Meldinger fra Norges Landbrukshøiskole*, 1923, No. 6-7, pp. 353-536, 26 fig. Christiania, 1923.

The author refers to experiments in electro-culture made with barley, grown either in pots or in water.

In 1920, continuous electrification was maintained day and night, as a direct current from the apex to the roots with an intensity of 10^{-8} ampères. No action favourable or unfavourable was observed. No effect resulted from increasing the air current to double the normal.

In 1921, discontinuous electrification was used, given as direct cusrent of one minute duration, at intervals of 15 minutes and was cut off at night; the intensity was the same as in 1920. The effect was favourable on the plants. No result was obtained by increasing or decreasing the air current.

In 1922, an alternating current at intervals of half an hour for one minute duration, with an intensity of 10^{-6} ampères was employed but gave no result. No result was obtained even with direct current (10^{-6} ampères per plant) combined with an increased air current so strong that the tips of the leaves withered. A. F.

192. Tractor Ploughing for Padi Cultivation.

JACK H. W. *The Malayan Agricultural Journal*, Vol. XIII, No 5, pp 142-144. Kuala Lumpur, 1925

The methods of the Malays in the cultivation of padi have been criticised as wasteful and antiquated, but are the results of practical experience.

The author discusses and compares the relative merits of buffalo ploughing and ploughing by tractor, his opinions being based on trials carried out with two well-known tractors.

As a result of investigation the author considers that tractors may have a future in the cultivation of large areas of padi, where the soils are fairly hard, and where irrigation is controlled, but that they are essentially for use by capitalists on large areas only, and their adoption is not probable in the near future. W. S. G.

193. Tests with a Rotary Tillage Cultivator on the Experiment Farm of the Agricultural High School, Vienna.

KASERER (Professor at the Agricultural High School, Vienna). Ein Fräsversuch zu Zuckerrüben auf der Versuchswirtschaft Gross-Enzersdorf. *Wiener Landwirtschaftlichen Zeitung*, No. 9, p. 69, part 4. Vienna, 1925.

A field which in 1923 grew potatoes was in the autumn ploughed to a depth of 15 cm. and, to remove any potatoes which might still

be left, then roughly harrowed. In December 1923, 200 quintals of stable manure per hectare were applied. On the 26 March 1924, 200 kg. of basic slag per hectare were applied. As the weather conditions were still very unfavourable — temperature very low and snow deep — a part of the field only could be ploughed to a depth of 20 cm., on April 19. The remainder was cultivated or cut to a depth of 15 cm. on April 26 with a 30 H. P. rotary tillage machine (frase) constructed by SIEMENS-SCHUCKERT. Both operations turned the manure into the soil.

The ploughed part of the field was then harrowed, a spiked roller was then used and again the harrow. The cut part of the field was also harrowed, so as to prepare it and bring it into a finer condition for planting.

On May 2 1924 the whole field was treated with a smooth roller. On the 3rd sugar-beet was planted at an average spacing of 42 cm. The further treatment of both parts was identical, except for the difference in nitrogenous manuring. One half of each experimental surface was treated with two dressings of Chile nitrate, of 200 kg. per hectare each, the other halves being given Leuna nitrate, two dressings of 120 kg. per hectare each. The amounts of nitrogen of each manure when calculated per unit surface were approximately the same

The yields obtained are given below:

TABLE I. — *Manurial experiments on rotary tilled and ploughed land.*

Crop yields	Manuring with Leuna nitrate		Manuring with Chile nitrate	
	rotary cut	ploughed	rotary cut	ploughed
Fresh crops in quintals per hectare:				
Beets	307	238	291	255
Leaves and tops	158	228	199	208
Sugar	17 75	16.50	15.76	16.32
Dry substance in % of green mass:				
Beets	23.17	22.05	21.41	23.06
Leaves and tops	16 69	15 46	13.25	13.24
Dry substance of the crop in quintals per hectare:				
Beets	58.33	41 95	47.18	42.53
Leaves and tops	26 88	35.18	26.34	27.55
Sugar	47 84	33.43	36.80	31.72

The results of the investigations on the physical conditions of the soil during the period of growing are given in Table II and were obtained by the Plant Cultivation Department.

It is seen that despite the abundant atmospheric precipitation of the summer, the humidity of the lower layers of the soil diminishes from the spring till autumn.

The first table shows that when arranged according to Chile and Leuna nitrate manure the cut field in each case gave a richer crop than the ploughed field. What strikes one most when looking through the figures in

PLATE XIV.

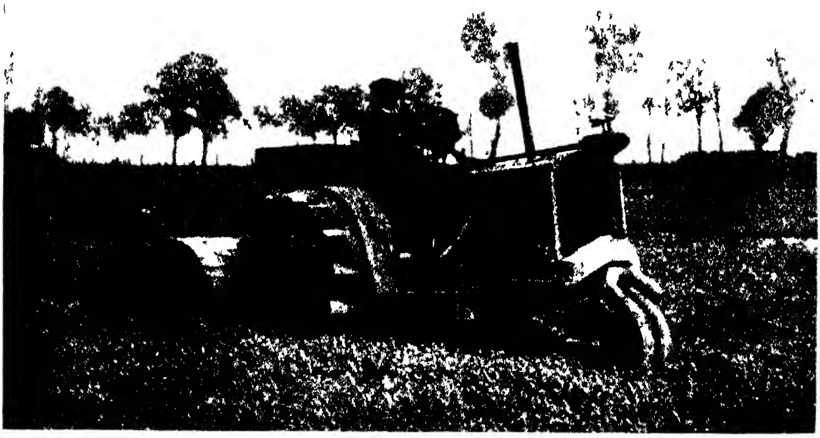


FIG. 57. — 30 HP soil rotary cutting machine

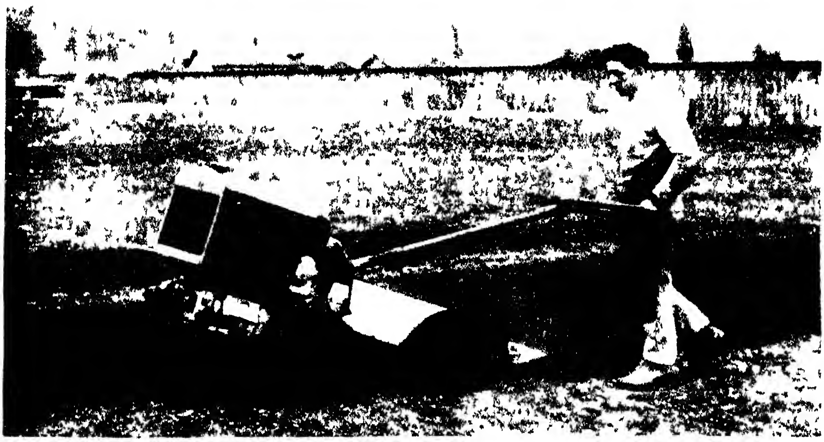


FIG. 58. — 8 HP «plantagen» soil cutting machine

PLATE XV.

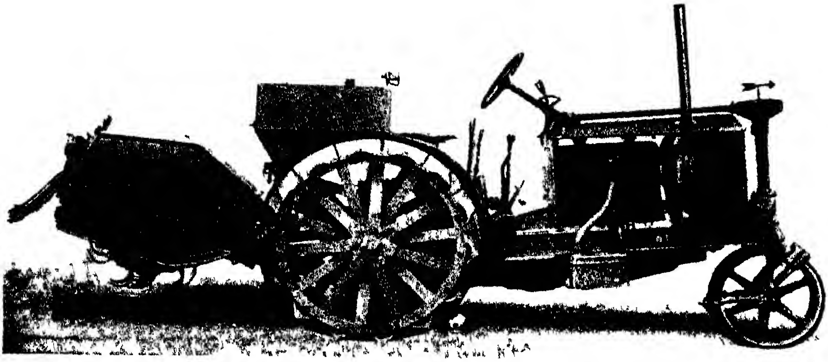


FIG. 59 — 30 HP G[illegible] or goods machine

FIG. 60 — Garden machine with handles

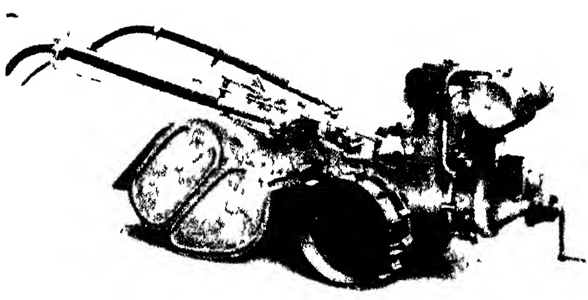


FIG. 61 — 4 HP Garden machine

TABLE II. — *Condition of the rotary cut and ploughed soils.*

Physical condition of the soil	Depth in cm:	Soil analysis					
		Rotary cut			Ploughed		
		26. IV	18. VII	7. X	26. IV	18. VII	7. X
Moisture content in weight percent.	—	12.8	11.4	20.3	13.3	11.9	14.9
	10	13.7	13.6	18.0	14.0	13.9	15.3
	25	15.1	13.8	13.1	15.1	13.9	13.0
Capacity for water in weight percent.	—	34.0	35.5	31.5	32.7	32.2	30.2
	10	35.5	34.1	27.5	33.9	32.9	31.3
	25	30.5	31.5	29.0	28.1	28.0	29.0

table I is the fact that for every 100 kg. of beets on cut soils we get only 51.5 kg. of tops and leaves when using Leuna nitrate and 56.2 kg. when using Chile nitrate, while on ploughed soils we get with Leuna nitrate 95.5 kg. and with Chile nitrate 84.1 kg. of tops and leaves; *i. e.* on the average we get from cut soils 53.8 kg. tops and leaves and from ploughed soils 89.8 kg. In other words, cutting shifts the relation between beet and leaves very much in favour of the former, a phenomenon characteristic of air nourishment in distinction to soil nourishment. From this the author feels justified in concluding that cutting with its intensive and uniform work of loosening the soil brings about a more rapid decomposition of the humus present in the soil and perhaps of the stable manure supplied, than does ploughing. Whether this is the correct explanation, or whether it may not be due to an impoverishment of the soil in carbon compounds on account of an increased assimilation, cannot be said with certainty at this stage; only further experiments can settle thispo int, and it is hoped to carry them out in the next few years. KASERER thinks that more CO_2 escapes from a cut soil than from a ploughed soil, and that the plant, being capable of satisfying its needs for carbonic acid by means of the comparatively small number of leaves it possesses, does not form any additional leaves.

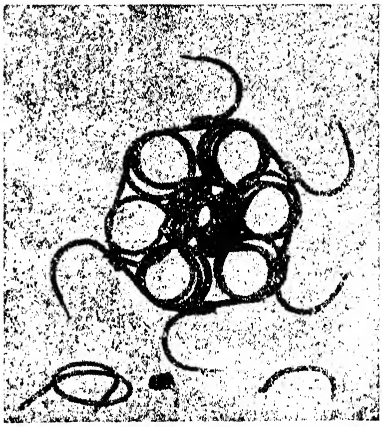


FIG. 62. — Part of Meyenburgian rotary cutting machine.

Another point noted by KASERER is that the cutting machine has also the advantage over the plough that it simultaneously performs a

[193]

number of tillage operations and hence makes unnecessary any further treatment of the field by the harrow, roller, etc It is however advisable to study further this question and especially when applied to different soils, the above experiment is only an attempt at a study of the usefulness or otherwise of this implement

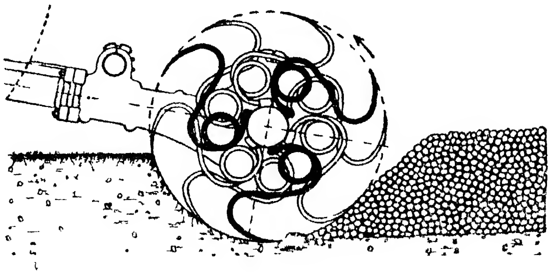


FIG 63 — Diagramatic section through the working parts of a cutting machine

The width of the work of the 30 H P. machine is 160 cm. the depth according to setting, up to 35 cm From 1/4 to 1/3 hectare can be tilled in an hour according to depth. The petrol consumption of the rotary tiller weighing 2700 kg fluctuates between 24 and 32 kg per hectare according to the depth of working

The machine has three different forward speeds (45, 60 and 105 cm. per second), and one backwards speed of 45 cm per second.

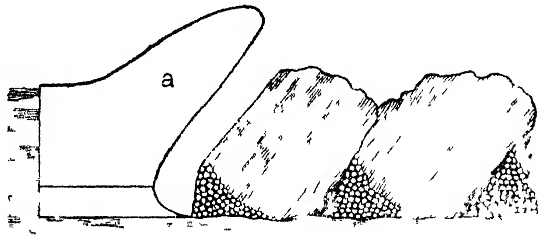


FIG 64 — Diagramatic representation of ploughing
a = the plough

Besides this large machine smaller machines are constructed by the same firm with engines developing 4 or 8 H P

H. K

194. **Flax-Scutching Machine.**

The Farmer's Journal, Vol V, No 12, pp 1929, illustr 5 Belfast, 1925.

The " Marshall " flax-scutching machine is semi-automatic in action. Experience has shown that completely automatic machines are not satisfactory, as every kind of straw receives the same treatment. It is not possible to guarantee uniform straw, and to allow for this, the " Marshall Scutcher ", although not requiring particular skill to operate, permits of varying treatment of the straw, and ensures a uniform product.

The machine only requires one horse-power (B. HP.) to drive, and occupies a space of 4 ft. 3 in. by 2 ft. Ball bearings to shafts, lubricators accessible while machine is running.

The advantages claimed for the " Marshall " are. greater yield of flax from straw than by other methods; larger output per man; more uniformly scutched and better cleaned fibre.

W. S. G.

RURAL ECONOMICS.

195. Efficiency-Increasing Methods of Remuneration.

ATEDING Dr. Leistungssteigerung bei Transportarbeiten im landwirtschaftlichen Betriebe. *Deutsche Landwirtschaftliche Presse*, Year III, No. 21, p. 247. Berlin, 1925.

The transport of large masses of goods which takes place year by year between field, farm and station, should and could be cheapened and speeded up through the introduction not only of technical improvements, but also of agricultural economic improvements, as for instance through a proper organisation of work and a suitable method of remuneration. The possibilities in this direction the author illustrates by a number of practical examples taken from estates where efforts have been made to find the methods of organisation of work and of its remuneration best calculated to increase efficiency.

The author points out next that the manager has to determine in each separate case the true measure of efficiency This may be the means of transport, the size of weight of the transported object, or even the area of land corresponding to the quantity of goods moved each referred to a unit of time. He then evaluates each separate phase, which together constitute the whole process of transportation, reckoning in each case time, space, money and effort. This analysis is the basis of a proper organisation of work and method of remuneration.

The transport work the author treats in the following manner transport of sugar-beet, digging and loading of potatoes, bringing in of grain, conveying of stable manure and compost conveying. For the different phases of work, e. g. digging, loading, conveying, unloading, spreading, etc. different methods of remuneration were used. The methods of remuneration used were by time, by piece work, by group agreement, by premium, which was either simple or was rising by degrees By economy of time, supervision and labour, splendid results were achieved, without in any way impairing the quality of the work or injuring the interests of the worker The particulars are illustrated by a number of examples. V F.

196. Changes in Estate Values in Germany.

ROTHKEGEL Welche Veranderungen im Werte der landwirtschaftlichen Besitzungen sind in Deutschland eingetreten ?. *Illustrierte Landwirtschaftliche Zeitung*, Year XLV, No. 19, p 227. Berlin, 1925.

The author attempts to establish the direction and the extent of the price variations which have taken place in the German estate market, and which are caused by the decrease of profits derived from agriculture, by the high interest on loans, by the high taxes and the general scarcity of available capital Moreover, the farmer must share his decreased profits with the creditor and the State thus involving a general rise in the cost of production. The well known " vicious circle " results : rise in price of products is followed by a decrease in consumption, which causes an over-supply,

followed by a fall in prices to meet the buying power of the poorest consumer. In these circumstances the farms which suffer most are, in "the isolated State" of THUNEN, those of worst economic conditions, and in present-day Germany, the farms on poor soils. On individual farms this finds expression in the fact that outlying fields of poor soils become unprofitable. Hence the profits and consequently the value of the land fell by different amounts for different soils and it is impossible to establish for all types of estate a general percentage decrease. Such a general percentage decrease, which will be true for all practical purposes of valuation, can be derived from the "valuation indices" to be found in pre-war official price lists. They each refer to one hectare of farm, including buildings, stock and land, and include farms of all sizes and of all the different qualities of soil. Assuming, as we are justified in doing, that the values of buildings and stock have changed only slightly and subtracting their value from the total values of the farm, we get the value of the land. Hence in the last resort fluctuations in the values of estates are really fluctuations in the values of land. When there is a fall in the total value of an estate, then the larger the proportion of that value which is represented by the value of the buildings and stock, the larger will be the percentage of decrease in the value of the land And this proportion of the total value is clearly relatively large for estates with pour soils. In pre-war Germany such estates always showed, in contradiction to the ground rent theories of THUNEN and RICARDO, a surplus above that required for the interest on loans and the expenditure on labour, *i. e.* when the value per hectare of such farms was 900 marks, and the price of the buildings and stocks was taken as 585 marks per hectare the value of the soil came to 315 marks per hectare. Nowadays, if such farms are cultivated at all, the profit from them is negligible. In the case of rye and lupins this profit may even become negative *i. e.* it does not suffice even for payment of the interest on loans. The fall in the income from farms with medium, good and best soils must have been equal to the income, before the war, from farms of the same size but on poor soils. The same is true of the value of land, and since we may assume that the costs of reconstruction of buildings and of replacing of stock are approximately the same as in pre-war times, the above statement is also true of the total value. From the total values of estates of all sizes and of small, medium, good and best land value, the author derives the net soil value (= capitalised ground-rent) of estates of the pocresr soil class, which are now unprofitable, and then compares those values with the pre-war values and gets as a result the tableon p. 437.

Despite certain possible and justified restrictions, the author believes in the usefulness of those figures, and next attempts to find out how far the prosperity and the readiness to buy of the German nation influences the estate market. Between the years 1896 and 1911, the wealth of Germany increased by 90 milliard marks by annually rising amounts. On the other hand its money wealth was to a large extent destroyed during the inflation period. That a considerable portion of that annually increasing wealth of the German nation was realised in agriculture is shown by the fact that parallel with this increase in wealth went a rise in the values and price of

Size in hectares	Farms paying land-tax on the basis of net return: 1 Thal/ha		3 Thal/ha		7 Thal/ha		13 Thal/ha	
	had a value of Mark-hectare and decreased to . . % of their pre-war value							
	poor		medium		(good)		(better)	
	Mark hect	%	Mark-hect	%	Mark-hect	%	Mark-hect	%
5	1050	82	2320	85	2050	88	3120	90
10	1530	78	1890	82	2520	87	[illegible]	89
20	1380	76	1710	81	2280	86	2710	88
50	1130	72	1460	78	1900	84	2400	87
100	1060	70	1380	77	1900	83	2280	86
500	940	66	1230	74	1700	81	2000	85
1000.	900	65	1180	73	1610	81	2000	84

estates, which was very considerable indeed Thus for example in Prusssia, in the case of farms of above 100 hectares, the rise in the period 1896-1914 was about 123 % The height of this rise in values was reached after the introduction of the increased grain duties in 1905 with their effects on agricultural profits The rise in prices as well as in the number of purchases was most marked for 1. farms paying the lower rate of land tax on the basis of their net returns, 2. consequently, provinces with prevailing poor and medium soils (East Prussia), 3 among these, the larger sized farms. The rise in prices was especially marked in the case of this class of farms farms with light soils which were previously in very small demand This demand increased, from prospective buyers with available capital, as technical improvements, especially applicable to this class of farms, were introduced and this increased demand allowed the prices to rise still higher From these consideration also, the author concludes that, now that events have taken an opposite course, this class of farm will suffer the greatest decrease in value which is in complete agreement with his first conclusions A E

107. **Farm Costing in Ireland.**

ADAMS J M *Journal of Department of Lands and Agriculture*, Year 25, No. 4, pp 351-373, tables 16, Dublin, 1925

Great progress has been made in experimental work and research, but there is need for enquiry on economic questions relative to production, marketing and distribution of agricultural products. The basis of agricultural economics is cost of production and of distribution

The production of farm commodities is subject to the law of diminishing returns. Within certain limits, cost may be reduced by increasing output or by improving the means of production, the normal productivity of land cannot be economically forced when prices are low. A stage is reached when the chemist and the engineer fail to be of service to the producer and the difficulty is economic.

It is of fundamental importance to the State to possess accurate economic data respecting cost of production and distribution of farm

commodities, capital invested, production per unit of area, capital and labour, sizes of farms in relation to production, system of farming and relative production.

Estimated costs are unsatisfactory and misleading; accurately recorded data are essential.

For the purpose of public evidence before an Agricultural Commission, the author compiled data from records and prepared tables of prices of farm requisites, wages, rates and items of farm expenditure for 1914, 1920 and 1922, and similar tables of prices of live stock and farm produce. The figures are based on the cost of producing crops on 18 farms.

No charge was made for interest on capital, or management.

The cost of production and value of crop per acre is compared in tabular form for the above three years. It appears that the value of the 1922 barley and potato crops was less than the cost of production, except in the case of very high yields. The author draws attention to the fact that barley meal is equivalent to Indian maize meal for pig feeding, and that pig feeders who do not grow barley would be well advised to buy barley meal in preference to maize, when it is at, or under the price of maize meal.

The cost of production of the milk from 204 cows on 13 farms is given for 1920, and the estimated costs for 1914 and 1922, including cost of delivery.

The average price realised in 1920 for milk was 1s.2d. per gallon, and the cost practically 11 d. per gallon; in 1922 price was nearly ½ d. per gallon less than cost of production.

Food and labour constitute over 80 % of the cost of keeping a cow, the importance of maintaining a good average yield from a herd is emphasised. There is no doubt that many cows in Ireland do not yield sufficient milk to pay for their keep.

The author demonstrates this by figures from a farm A, on which the cows were graded and milk records kept, and farm B, where poor quality cows formed the herd, and although the cost of keeping the cows was low, the cost per gallon of milk was very high.

	Cost of keep per cow 1920	Average yield of milk per cow	Cost of production per gallon
A	£ 25–10–8	727 gallons	8.5d
B	£ 17–14–11	323 »	13.2d

From the expenditure and receipts of the farms dealt with, index figures were ascertained for the given years

	1914	1920	1922
Index of expenditure	100	230	192
Index of receipts	100	253	147

Thus the purchasing power of farm products, taking 1914 as a basis, increased about 10 % in 1920, but fell 23 % in 1922.

Financial results on costed farms indicate that in 1922 the farmer barely received remuneration for his own labour at current rates, and nothing in his capacity as capitalist and manager. With the fall in

wages in 1923 he received remuneration for his labour at a reduced rate, and 10 % of the output as return for his capital and management.

A scheme for investigation of farm finances was put into operation in 1924, but results will not be available until the end of the accounting year on these farms. W. S. G.

198. **Pre-War and Post-War Farm Costs of Wheat Production in the North American Spring Wheat Belt.**

Wheat Studies of the Food Research Institute, Stanford University, California, Vol. I, No. 1-6. and *Supplement*. Stanford, 1925.

The Wheat Studies of the Food Research Institute summarise an extensive analysis of available data on farm costs of producing wheat in the spring-wheat belt of the United States and Canada, under pre-war and post-war conditions.

The spring-wheat belt of North America includes the States of Minnesota, North Dakota, South Dakota and Montana, and the Canadian provinces of Manitoba, Saskatchewan and Alberta.

The procedure of the studies has been to construct, on the basis of the Canadian investigations for 1911 and 1923, and the United States investigations for 1909 and 1923, statistics of average yearly farm costs in each political sub-area of the spring-wheat region, for the periods 1908-14 and 1921-24. Numerous estimates and approximations had to be made, but material resulted which is more significant for intensive comparative study than any other published data. The importance was brought out of the influence of yields on costs per acre and the effect of summer fallowing on costs per acre.

Identical principles of valuation were employed throughout for items which enter into total costs per acre, excluding land charges. These items were materials costs, and costs of man and horse labour, materials were charged at cost. Labour charges were calculated on the basis of current rates for similar labour in the respective areas.

Farm costs of producing wheat may be expressed either per acre or per bushel, exclusive or inclusive of land charges. Costs per acre, excluding land charges, best reflect differences in technical conditions of wheat production. Costs per bushel including land charges are necessary in judging the relative ability of areas to produce cheaply.

The factors causing variations and increases in costs are: prices of labour, prices of materials, yield per acre, farm machinery and cultivation methods, summer fallowing, transportation facilities between farms and markets, and the practice of breaking new land. High yield affects costs per bushel in that it increases per acre costs of threshing and marketing by increasing the quantities per are. Summer fallowing increases per acre costs because it necessitates extra cultivation and involves double charges for land. To break new land increases expense owing to the greater labour required for ploughing and cultivation, and fallowed land must be cultivated although it lies idle. The crop of wheat grown on fallowed land must be charged with two years' rent. The practice of following extensively is much adopted in Canada, but not in the

United States. No one knows exactly how much higher Canadian yields must be above American, in order that Canadian costs may be lower than American costs. An additional yield of five bushels per acre will certainly suffice, but one bushel certainly will not.

A careful study of the data in these papers will show that summer fallowing is of such importance in its influence on costs that it serves largely to invalidate the current opinion that costs of wheat production are lower in the Canadian than in the American section of the springwheat belt.

The calculation of land charges and their inclusion as costs, showed diminished differences in costs per bushel. Costs per bushel, excluding land charges, ranged from 81.5 cents in Saskatchewan to 97 7 cents in North Dakota ; but costs per bushel including land charges ranged only from $ 1 08 to $ 1 20 in the same areas.

The general impression that Canadian spring-wheat growers are able to produce at materially lower costs per bushel than American farmers is not well founded. It appears that owing to the practice of summer fallowing, the yield per acre in Canada must be about three or four bushels in excess of American yield before costs per bushel are equalised in the two countries. For the period 1921-24, Canadian costs per bushel have been slightly lower than American

To base a wheat tariff on differences between costs of production in Canada and the United States is neither scientific nor practical. It is not correct to assume that a normal or semi-permanent difference in production costs exists , yet such an assumption lies behind the present duty of 42 cents

Profits declined in all areas between the two periods, for costs rose faster than market prices.

Variations in profits per acre of wheat do not measure prosperity in the spring-wheat belt satisfactorily Wheat was and is of unequal importance between any two areas, or between Canada and the United States, because other crops and live-stock were and are of unequal importance as sources of farm income. Conditions of tenure differ in different areas ; low profits or losses are more of a menace to prosperity in an area where tenants or mortgaged farms are more numerous. To employ State averages may misrepresent the facts not only of profits, but of yields, market prices and costs as well. This misrepresentation cannot be avoided, so long as published statistical material is compiled upon the basis of political geography, rather than upon that of economic geography.

Analysis of the best statistics obtainable on wheat in the spring-wheat belt throws little light upon fundamental economic problems. Cost statistics, particularly those applicable to crops whose yield is variable, are exceedingly unstable. The most significant aspect of cost statistics is that they sum up and reflect changes in the conditions of agricultural production. Their value in diagnosing agricultural prosperity, or in providing a sound basis for price-regulating legislation, direct or indirect, is slight.

In the case of the United States maintenance of an export surplus

of wheat cannot properly be urged on the ground of insurance against famine or even serious food shortage Such danger is negligible even with a world shortage, considering food resources of the country, possibilities of substitution, transport facilities, and the strong economic position of the country In short, any export surplus of wheat is by no means indispensable to the United States,

No tariff policy has yet been formulated that will protect agricultural or industrial enterprises from the readjustments necessary after a period of over-expansion or from losses incidental to such readjustments

W S G

199 **The Returns fron Sugar-Beet Growing in Germany and Czechoslovakia.**

I. GARCKE. **Die Kosten des Anbaues der Zuckerruben.** *Illustrierte Landwirtschaftliche Zeitung*, Year XLV, No. 23, p. 275. Berlin, 1925.

II UMLAUF **Kultur und Rentabilitat der Zuckerrube** *Landwirtschaftliche Fachpresse fur die Tschechoslowakei*, Year III, No 13, pp. 113-114. Tetschen, 1925

I The author attempts to determine the present limits of profits from sugarbeet cultivation in Germany He starts from the following data wages per man per day 3 50 marks horse per workday 4 00 mks, one quintal stable manure 0 80 marks, one quintal beets 4 00 mark, one quintal beet tops for sour fodder 2 00 marks, one quintal dried slices 10 00 marks, - crop per hectare 3000 quintals of beets, 240 quintals of clean beet (20 % loss), 150 quintals beet tops and leaves and 105 quintals of ensilage (30 % loss)

The calculation of the expenditure per hectare is as follows

(1) Autumn cultivations Clearing land 13 20 mk, 300 quintals stable manure utilised 60 % 144 00 mk, loading 18 60, cartage 59 00 mk, spreading 4 80 mk, deep ploughing 72 00 mk . . . . 321 60 mk.

(2) Spring work · Cleaning, spreading artificial fertilisers, digging, harrowing, rolling, sowing, further rolling and harrowing, 60 00 mk, 2 qs ammonium sulphate during tilling and 2 qs sodium nitrate as a top dressing, 96 00 mk, 4 qs superphosphate, 34 00 mk, 2 qs 40 % potash 15.00 mk . . . . 205 00 mk

Total . . 526 60 mk.

(3) Cultivation work Three hand and two machine hoes, working separately and together . . . . 188 00 mk

(4) Harvesting Digging 72 00, loading and unloading 8 pfennings per quintal, 24 00 mk, cartage of beets and leaves 92.00 mks . . . . 188 80 mk

(5) General costs Rent 120 00 mk per hectare, Interest on capital 80 00 mk, taxes and rates 48 00 mk, general costs 12 00 mk . . . . 260 00 mk

Total expenditure per hectare . . . 1083 40 mk

Returns :

240 quintals clean beets at 4 mk	960.00 mk.
105 quintals ensilage at 2 mk	210.00 mk.
12 quintals 5 % dried slices at 10 mk . . .	120.00 mk.
Total return per hectare . . .	1290 00 mk.

There is thus a net gain of 206 60 mk per hectare If the price obtained for beets falls, however, to 3 marks per quintal for the same crop,

TABLE II – *Profits of sugar-beet compared with other crops at Sokol.*

I	II	III	IV	V	VI	VII
Cultivated Plant	Yield in quintals	Value per q	Value of the yield	Cost of cultivation	Removed for food	Gross profit
Sugar-beet	270 quintals of beet	18	4860	1 — 3 Cultivation of the different harvests	N, P_2O_5, K, Ca in money value	Column (IV) — (V + VI)
	175 » leaves	4	700			
	148 *) quintals free slices	5	740			
	27 kg free seed	**)12	324			
	free sugar		90			
			6714	1200	1093	4421
Wheat	31 q grain	240	7200			
	50 q straw	20	1000			
			8200	450	1010	6740
Oats	25 q grain	220	6250	450	704	5096
	50 q straw	25				
Potatoes	180 q	40	7200	1100	782	5318
Flax	35 q straw	160	7845	700	540	6005
	5 5 q seed	350				
	4 q bolls	30				
Caraway	12 q seed	800	10000	650	?	> than with 270 of beet per hect
	20 q straw	20				
Poppy	10 q seed	750	7500	900	?	> do
Rape	18 q seed	350	7000	700	926	5374
	35 q. straw	20				
Hemp	40 q stems	120	8000	?	?	> than with 270 of beet per hect.
	8 q seed	400				

(*) 55 %
(**) per kg

instead of a gain there is a loss of 33.40 mk. and the limit of profitability is for a minimum yield of 320 quintals clean beets per hectare. This yield can be obtained with the given manuring and favourable weather conditions. When, however, the price falls below 3 marks per quintal for beets, the crop becomes unprofitable.

In Czechoslovakia sugar-beet cultivation is only profitable in those parts of the country where with heavy manuring and very careful attention to all field cultivation (subsoiling etc.), rolling, hoeing and harvesting, the yield should be 350-500 quintals per hectare. If yields are smaller, most other cultivated crops would give better profits. Where such yields are not obtained and where unprofitable sugar-beet cultivation is carried out only on account of rotation of crops, the author advises a change to other industrial crops. This is also recommended from an agricultural political point of view. Since $^2/_3$ of the sugar must be exported, the sugar trusts depress the price of the sugar so much that, even with, a yield of 270 quintals per hectare, the beet cultivator already shows a loss. The author suggests a close combination of all sugar-beet cultivators, and shows in the preceding table the profit of sugar-beet cultivation, as compared with the most important crops and especially with the recommended commercial plants (see page 442). V. E.

AGRICULTURAL INDUSTRIES.

Plant Products.

200. **The Classification of Cereals in Roumania.**

IONESCU SISESTI, G. Standardizarea di Clasificarea cerealelor. *Viata Agricola*, Year XVI, No 2, pp 33-37. Bucharest, 15 January 1925.

The author examines the proposal of the Roumanian Government regarding the introduction of an enactment defining types of cereals and making a classification of crops. The author emphasises the importance of this measure and points out the drawbacks of the present condition of affairs, illustrating the difficulties arising from the subdivision of agricultural production due to agrarian reform, the consequent variety of the products and absence of any uniform stocks, of installation for grading or storage, of means of transport, etc., and consequently, the impossibility of obtaining credit on the crop and of arranging for sale at the right time.

These difficulties could be removed by the provision of warehouses, the defining of types and compulsory grading, which would also influence cultivation, since the price being based on quality, the farmer would tend towards the production of superior crops.

The author reviews what has already been done by the Roumanian

Government in this field since 1897 and gives fundamental suggestions for the regulations for the grading and storage of cereals including:

(1) Clear definition of the objects proposed by the system of defining types and compulsory grading, first in the ports of exportation and then in the interior, according, as the present defective warehousing system is completed.

(2) Constitution of an Association representing all interests — producers, dealers, banks and co-operative sociaties — with national capital for the construction and working of the warehouses. This Association should be a private corporation with partnership of the State, in conformity with commercial law.

(3) The grading should be effected by competent agents of the State appointed for the purpose, and special bodies and associations, Chambers of Agriculture, Agricultural Syndicats, etc. should cooperate in the definition of types and in the creation of the organisation for classification and grading.

Transactions should only be done on the basis of certificates issued by the warehouse management, indicating the class to which the produce belongs and the quantity released.

The said certificate would form the " warrant " or storage receipt and could be discounted at the National Bank or other banking institutions, to facilitate credit, and the law should recognise its character as a negotiable document.

This enactment does not constitute a monopoly of cereals, since trade remains perfectly free, but it facilitates trade by making known the grades of ing known the grades of Roumanian cereals intended for exportation, grades which will be guaranteed by the State and which will benefit by this measure; moreover, the confidence of the Exchange will be increased and as an immediate consequence, the present fluctuating prices will be stabilised at a higher level. W. L.

201. The Treatment of Flour with Chlorine Gas and by the "Golo" Process.

NEUMANN M P and KALMING H (Institut f Bäckerei der Preussischen Versuchs- und Forschungsanstalt f Getreideverarbeitung und Futterveredlung). Die Behandlung der Getreidemehle mit Chlorgas und das sogenannte Golo-Verfahren zur Verbesserung der Mehle *Landwirtschaftliche Jahrbucher*, Vol LXI, No. E, pp 305-310 Berlin, 1925

Among the measures suggested in recent years for the improvement of flour is that of treatment with chlorine gas, introduced about thirty years ago. The bleaching which results is due to the oxidation of the yellow colouring matter which is found in the fats of the flour. This method however, is not common because it has certain drawbacks. It has now been replaced by the " Golo " process in which 0.5-1.5 % of nitrosyl chloride is added to the Chlorine gas. The gaseous mixture to which is added a certain amount of air is passed into a receiver containing the flour which is constantly shaken and thus in a short time comes into close contact with

the gas. The flour rapidly absorbs the gas; in concentrations of 0.015-0.02 which are considered normal, the flour retains no odour, nor can any traces of hydrochloric acid or of nitrous acid be found. Under the influence of the gas, the swelling capacity of the colloidal substance of the flour, especially of the albumen, increases. A greater capacity for water results and therefore a greater quantity of dough, which is more tenacious, softer and more susceptible of increase in volume during the process of bread-making.

This action is due to increased acidity in the flour, both of measurable acid and of hydrogen-ion concentration. With it also increases the solubility of the nitrogenous substances, if however these two factors increase beyond a certain point, as happens especially with soft wheats, the gas may have no effect or it may even have a negative effect, as is the case when the action is too prolonged. The gas has no effect either on the keeping qualities of the flour or on the activity of the enzymes of the flour. Complete bleaching of the flour will result, if the treatment is properly carried out, and the yellowish colour will disappear; if on the other hand the quantity of gas is excessive the flour may take a greyish tone.

The action of the gas depends mainly on the accurate carrying out of the treatment, which may be considered as harmless on account of the very small quantity of gas used and the cleanly manner in which the process must be performed. A. F.

202. **Preservation of Silage.**

KOCH L., Conserveeren van veevoeder door inkuilen. — *Algemeem Landbouwweekblad voor Nederlandsch Indie*, p. 1. Baandoeng, 1924.

After the forage has been in the silo for four to five months, the loss is 10 %. The carbo-hydrates undergo a great diminution: on the other hand the fat content is greater, probably because the bacteria transform the carbohydrates into fats. The results are similar to those obtained in America.

A. F.

203. **Industrialisation and Commercialisation of Fruit Growing in Roumania.**

STEFANESCU D. L. " Industrializarea si comercializarea fructelor " *Buletin Agriculturei*, Year 5, II Series, Vol IV, No. 10-12 October-December, Bucharest, 1924.

The author points out how, in spite of the good climatic conditions throughout the country, fruit-growing, on account of unscientific methods, leaves much to be desired.

There are in Roumania about 100 million fruit-bearing trees of which about three-fourths are plum trees, but the distribution in the districts of the species is very unequal. Thus in the old Kingdom, out of 47 million fruit-bearing trees, 42 millions are plum-trees.

The mountainous districts (Muscol, Prahova, Argos and Dambovita) have each about 6 million plum-trees, while the Dobruja and Southern Bessarabia have scarcely any.

The plum-tree represents 90 % of the fruit trees of the Old Kingdom, 65 % in Transylvania, 32 % in Bucovina and 6.1 % in Bessarabia.

Fruit-growing suffers principally from the climatic conditions, from fungoid diseases, parasites, etc., to which are added the damage caused by complete want of care and of scientific methods of picking, transport and storage of the fruit.

A quite insufficient use of orchard products is made in Roumania and the complete absence of industrial and trade organisation is a source of great loss. The value of the annual fruit production of Roumania exceeds 2 thousand million *Lei*.

The author mentions the various uses of such potential wealth :— the manufacturing of jam and dried fruit from the plums, introduction of various fruit wines, sparkling table wines, preparation of syrups and drying of fruits and vegetables.

The export of these fruits in the above-mentioned forms would assure an income of hundreds of millions of *Lei* to the country.

As regards utilisation of the products of Roumanian orchards, in the majority of cases, especially in the Old Kingdom, the plums are made into " tuica " by a process of distillation. This is a not very wholesome beverage widely used by all social classes of the country as an aperient and common beverage, but not exported as it is not liked in foreign countries.

64 million plum trees yield a gross output of 64 thousand trucks of fresh plums, or the equivalent of 18-20 thousand trucks of dried or preserved plums, if one quarter only be used for industrial purposes other than the manufature of " tuica ", there would be about 4-5 thousand trucks of dried plums or jam for consumption or exportation. Considering only the production of 9 Departments, with approximately a total of 41,107,269 plum-trees, and allotting only one quarter of their output for industrial purposes, 3-4 thousand trucks of dried plums and jam could be obtained having a value of 400 million *Lei* (at 10 *Lei* per kg. of dried plums). Half the quantity might be made into dried plums and the other half into jam. The work would occupy about 4 thousand Bosnian ovens for a month, and perhaps an equal number of boilers for the jam.

The author alludes to the exportation of fruit from Roumania to Austria and Germany in the years 1913-1914-1915, which reached an average of 285 trucks a year.

For Bessarabia alone, taking the average of the ten years 1901-1910, 2000 trucks of fruit were exported. As in 1915 the production of Bessarabia was 8723 trucks of fruit, one-quarter of the output of fruit from this Province might have been exported.

The markets for dried plums of superior quality would be :— Russia in the east ; Germany, Austria, Belgium and England in the west. The industrialisation of fruit-growing has for some years occupied the attention of the Ministry of Industry and Commerce and that of Agriculture and Domains in Roumania. In about 4 years (1909-1912) with Government assistance, 500 ovens of the Bosnian system were constructed ; 2000 ovens were made during the occupation. Various tanks were made since 1910 at Pucioasa (Dambovitza) and Rusavat (Buzen) as well as two large

factories, one at Golesti-Badi (Muscel) and the other at Istritza (Buzen), each with a capacity for sterilising about 2000 kg. of dried plums in 24 hours. The preserved fruit industry is meanwhile in full progress in the country, gradually eliminating similar foreign products from the market.

In order to be in a position to organise the production and sale of fruit with the object of its commercialisation the author proposes .—

(1) Detailed research on the soil and climate, of the cultivation of each species and variety of fruit, as well as their correct cultivation, picking at a suitable moment, suitable packing methods, establishing for this purpose schools, exhibitions, competitions, conferences and publications.

(2) Gradual change of the present destination of fruit products, especially plums, with industrialisation, adopting the improved Bosnian oven, an oven capable of dealing with about 5000 kg. in a season.

(3) Careful preparation of the goods, superintendence and control of markets, establishment of contacts by means of Chambers of Com-tion of local consumption by supplying hospitals, prisons, etc.

(4) State cooperative aid for the construction of ovens, creating for the present two centres of production — Golesti and Istritza — where the two factories might prepare (by sterilisation) 70 trucks of plums for exportation.

(5) Construction of nursery plantations, propaganda work with specialised schools of fruit-growing, conferences and shows.

(6) Lastly, formation of a competent directing staff under a Special Directorate of Fruit-growing to be created in the Ministry of Agriculture.

S. L.

204. **Drying of Apricots.**

GRASOWSKY A *Commercial Bulletin*, Vol 1, No 8, pp 106-108 Jerusalem, 1925

The author gives the chemical composition and nutritive value of dried apricots, and the advantages to be gained by drying the fruit.

The method of drying apricots, is described as follows :— The fruit is picked when ripe, as green fruit produces a tasteless product, and is then cut in halves, spread on trays and taken to the sulphuring house.

The fruit is sulphured for the following reasons : Sulphurous acid deoxidises colouring matter and prevents darkening and the decomposition of nitrogenous compounds. Spores are destroyed, which checks putrification and fermentation, also, the eggs of insects are destroyed, and the fruit is made secure from insect attack.

Sulphuring also ruptures and enlarges the cells of the fruit, makes the texture more porous and hastens drying. The length of time required for sulphuring varies with the fruit, the draught and the quality of sulphur. The time taken is usually about 2 hours, and about 5 lb. of sulphur per ton of fruit is employed.

After sulphuring the fruit is dried in the sun ; the time required depends on various factors, but generally after 4 days the apricots are

three-fourths dry, when the trays are stacked and the drying is finished in the shade.

When dry the fruit is put in bins and sweated, which equalises the moisture, makes the apricots less brittle and the product more palatable.

After sweating, the fruit is sent to the packing house where it is usually re-sulphured, graded and packed in wooden boxes for market.

Mention is made of the limiting factors to apricot growing in Palestine, e. g., cold winds and rain at time of blossoming and the Fruit Fly (*Ceratitis capitata*), which all cause serious damage, and the prevalence of Gummosis. W. S. G.

205. **The Fungicidal Action of Sodium Fluosilicate and Hydrofluosilicic Acid in the Coagulation of Rubber.**

LAMBERT A. *Archives des Instituts Pasteur d'Indochine*, No. 1, pp. 57-64. Saigon, 1925.

Hydrofluosilicic acid and fluosilicate of soda have been recommended as coagulants in a patent taken by the Rubber Growers' Association in the name of Mr. EDWARDS.

The advantage claimed lies in the fungicidal action of the new coagulant which would prevent the formation of mildews on the surface of the rubber during the process of drying which depreciate the market value of the rubber.

The writer purposed to investigate the fungicidal action of these coagulants, the yield of washed rubber, the chemical composition and the mechanical properties of the rubber obtained.

The mildews which grow on rubber are of the *Aspergillus* and *Penicillium* type.

The optima conditions for mildew development are a slight acidity in the medium, a temperature near 32°-34°C. and a suitable hygrometric condition. In dry air growth is slower than in moist air.

It should be noted that rubber, always slightly acid after coagulation in an acetic medium, kept in a surrounding temperature of about 30°C. in an insufficiently ventilated drying shed where the hygrometric condition is marked, is in a condition favourable to the development of spores by which it may be infected.

From the investigation made by the author the following conclusions may be drawn: —

(1) In the conditions of the experiment, the fungicidal action of hydrofluosilicic acid and of fluosilicate of soda has not been sufficient to prevent completely the growth of mildews. However, development and fructification have been very much retarded. It is therefore possible that in a drying shed where the moisture conditions are less favourable this delay may allow of drying the rubber to the point that the development of mildews would no longer be possible.

(2) The fungicidal action of fluosilicate of soda proved superior to that of fluosilicic acid.

(3) Coagulation by fluosilicate of soda in suspension in water is better than that obtained by the salt in powder. In the latter case the latex should be poured on the powder and not the powder into the latex.

(4) The chemical composition of the two samples of rubber is much the same. It is scarcely possible to find any difference except a slight increase of ash and a decrease of resins in the sample coagulated with the fluosilicate.

(5) Coagulation with fluosilicate of soda is deficient, compared with that with acetic acid.

(6) The characteristic coefficients of each rubber, with optimum vulcanisation, are respectively 1.05 for the sample coagulated with acetic acid and 0.91 for the sample coagulated with fluosilicate of soda. The latter is only worth 86.8 % of the sample coagulated with acetic acid.

(7) The characteristic coefficients after keeping are respectively, 0.66 for the sample coagulated with acetic acid and 0.45 for the sample coagulated with the fluosilicate. After keeping, the latter is not worth more than 67.6 % of the sample coagulated with acetic acid.

P. C.
(Correspondent for Indo-China)

Animal Products.

206. The Constitution of the Fatty Globules of Milk.

DEGLI ATTI M. (R. Scuola sup. di Agricoltura di Portici). Ricerche fisico-chimiche sulla costituzione dell involucro dei globuli grassi del latte. *Annali della R. Scuola superiore di Agricoltura in Portici*, Ser. II, Vol. XIX, pp. 1-23, bibl. Portici, 1924.

The various hypotheses regarding the constitution of the fatty globules of milk appear to have little correspondence with the real facts, especially as they do not explain the observed phenomena, or are even in contradiction with them. The author puts forward a new hypothesis based on the formation round the globules of a thin layer of calcium soaps (soaps of the various acids contained in butter and especially insoluble soaps of the higher series of fatty acids).

This mixture of soaps, besides remaining attached to the globules themselves, has the property of fixing the suspended and colloidal particles contained in the milk (insoluble phosphates, casein), forming a complex viscous, heavy compound which envelops the fatty globules and keeps them in an almost stable emulsion.

By means of this hypothesis are explained :—

(1) The considerable density of the globules covered with calcium soap and the difficulty in rising of cream.

(2) The fact that, with any chemical and physical treatment capable of displacing the calcium and, consequently of decomposing the calcium soap, the rising of the cream and all the phenomena which are observed in making butter take place at once. On the other hand, treatment with

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agents incapable of causing the decomposition of the calcium soap retards and renders incomplete the formation of butter.

(3) The fact that the formation of butter is easier with acidified cream (lactic acid which decomposes the calcium soap) and more difficult with sweet separated cream, precisely on account of the resistance which the soapy covering offers to the formation of butter. A. F.

207. **A New Method of Distinguishing Fresh from Boiled Milk.**

HECKMA E (Rijkslandbouwproefstation Hoorn). Een nieuwe methode ter onderscheiding van rauwe en verhitte melk. *Verslagenv an Landbouwkundige onderzoekingen der Rijkslandbouwproefstation*, No XXIX, pp. 49-60. The Hague, 1924.

To 5 cc. of milk, previously filtered through cotton, is added 5 cc. of a 0.1-0.2 % solution of "trypanblue" in distilled water, or better, in physiological solution. The mixture is placed in a tube of the separator, the lower part of the tube being capillary (for example, Trommsdorff's tube). It is left at room temperature for 10 minutes and then rotated for 20 minutes. The cream and the skim milk are poured off and the small amount of liquid remaining above the sediment is withdrawn by means of a capillary pipette. The sediment is then thoroughly mixed with a capillary pipette. One or two drops of the sediment are taken (always the same quantity) and examined under the microscope, taking care to spread the matter evenly between the object-glass and the cover-glass. The sediment is examined with a dry lens, and the number of stained and unstained cells, the intensity of the staining and the number of cells forming the average for 25 squares should be noted.

Care should be taken not to mistake the cells for small drops of fat or scum membrane.

The following results are obtainable: —

(1) Fresh milk. Only unstained cells (relatively large) are seen.

(2) Strongly heated milk (10′ at 70° C.; 2′ to 3′ at 80°-90° C.; 1′ to 2′ at 100° C.). A great number of deeply stained cells are seen, while unstained and slightly stained cells are absent.

(3) Milk heated to a low temperature (10′ to 30′ at 60°). A fair number of slightly stained cells

(4) Mixture of fresh and strongly heated milk. Side by side with deeply stained cells other unstained cells are seen.

This method also holds good if formalin or bichromate of potassium has been added to the milk, in which cases STORCH'S and ROTHENFUSSER'S reactions (enzyme tests) give no indications. A. F.

208. **Cold Storage of Eggs.**

MORANT T. and PIQUE J. *Cold Storage and Produce Review*, Year 28, Vol. XXVIII, No. 32, pp. 9-11, 2 fig. London, 1925.

Results of researches on the cold storage of eggs, made at the Low Temperature Research Station, Cambridge, for the Food Investigation Board of the Department of Scientific and Industrial Research.

(1) Only very fresh, clean eggs, which have not been subjected to a temperature of more than 15.5°C (60°F.) should be used for cold storage, since at 21°C. (70°F.) a visible development takes place in the egg ; even at 16.1°C. (61°F.) embryonic modifications are produced.

(2) The storage temperature should in practice be maintained between 0° C. and + 0.5° C. (32° to 33° F.).

(3) To avoid as far as possible loss of weight, the degree of humidity should be kept constant at 80 % and the temperature at 0° C.

(4) To avoid " storage taste " the eggs should be placed on metal plates, or plates rendered impermeable and not susceptible of absorbing odours.

P. D.

PLANT DISEASES AND PESTS.

Non-parasitic Diseases.

209. Manganese Treatment for the " Dörrflecken " Disease of Oats (Moor Colonial Disease).

HILTNER F. Die Dörrfleckenkrankheit des Hafers und ihre Heilung durch Mangan. Das Kohlensäure-Mineralstoff-Gesetz, ein Beitrag zur Physiologie dar nichtparasitären Pflanzenkrankheiten. *Landwirtschaftliche Jahrbücher*, Vol. LX, part 6, pp. 689-709. Berlin, 1924.

The " Dörrflecken " disease is known as a non-parasitic disease of oats and under certain circumstances also of other plants. It is found especially among plants growing on sandy soils and on moors, and has the following course : after the seed has germinated in the normal manner the plants change colour slightly, then on the leaves appear red-bordered spots from which the chlorophyll disappears ; finally the leaves gradually dry up from the base of the stalk to the tip. Sometimes the disease stops after a time, but oftener the plant perishes. Many attempts at explaining its cause can be found in the literature, among the causes suggested being both acidity and alkalinity, nitrite forming bacteria, lime and many others. Nobody, however, suspected the physiological processes occurring in the plant.

In manganese sulphate HUDIG found a very efficient weapon for controlling the disease, but no final and satisfactory explanation for its action was so far given.

The author tried to investigate the relation between the factors conditioning the disease and the curative action of the manganese and to explain satisfactorily the cause of the disease. For this purpose he investigated a large number of oat cultures in water and in the open field, and the following are the results obtained.

Experiments in water. The " Dörrflecken " disease is not connected with the soil, for it may even occur in purely mineral solutions. The severity of the attack is largely influenced by the form of the nitrogen given to the plant. Yellow oats and " *Fichtelgebirge* " oats respond quite differently to the disease. MnO_2 has the same preventive influence as $MnSO_4$, but only in the series of experiments with KNO_3 were negative results obtained. The disease is not confined to alkaline reacting bodies, for it may be even found in decidedly acid solutions (solutions of $(NH_4)_2SO_4$) and is then also curable by $MnSO_4$. The presence of a nitrite in the solution may lead to the disease — and hence its appearance on moor soils with a lime fertiliser — but this is not the only condition favouring the appearance of the disease The disease appears even in the complete absence of calcium bicarbonate, and hence the explanation of the beneficial action of the manganese as being due to its action on the former or on the alkaline humus matter is certainly insufficient. Similar to manganese sulphate is the action of many other manganese compounds *e. g.* manganese chloride, manganese dioxide, manganese carbonate and even manganese mud. Finally these experiments in water proved that optimum limit in the case of oats is not yet reached, even with 0.5 gm. $MnSO_4$ in 600 cc. of water.

The pot experiments proved that the action of the manganese was more beneficial the stronger the hold the disease had previously on the soil investigated. Its action was greatest on alkaline garden soils which were manured with KNO_3 and the result was a surplus yield of 91 %. We are justified in stating that all plants which growing on calcareous soil suffer from nutritive disturbances are manganese-requiring plants, and one of the experiment showed that every 5 gm. of MnO_2, in the first year, had a more beneficial influence on the crop yield than 2 ½ gm. $MnSO_4$ on 6 kg. of soil with an especially high Ca and Mg carbonate content. The beneficial action of the $MnSO_4$ was also noticeable in following years to the same extent. The same beneficial action was also noticed in the case of another plant disease, which may be ascribed to nutritive disturbances, and in which the lower leaves withered gradually from the tip towards the base. On application of a manganese treatment new leaves appeared. It was further found that manganese cannot be substituted by other reagents which perhaps assist oxidation in the soil. The disease appeared less frequently in soils with a purely organic manure than in soils having a purely acid manure, and hence the action of the manganese in the first case was weaker. The effect of various nitrogenous manures, which was investigated in the former series of experiments was again examined and it was found that sodium nitrate, crude calcium cyanamide were injurious and somewhat less the physiologically acid ammonium sulphate, while the neutral $(NH_4)_2SO_4$. $NaNO_3$ acted as a preventive. The most injurious, however was KNO_3, whose nitrogen is only assimilated in the presence of manganese which itself prevents the appearance of the disease. The same was noticed in the series without nitrogen, with the limitation, however, that in these cases the sulphate acted much better than the chloride. In the case

of KNO_3 manure the beneficial action of the manganese found expression in a much greater grain yield. It may be inferred from this that the action of the manganese is catalytic in that it assists in either the nitrate reduction or nitrite oxidation or may be in the albuminoid syntheses, by supplying rapidly the necessary bodies, whose absence may cause the above mentioned nitrogen transformations to stop at injurious intermediate stages. It is probable that these inert and lacking substances are carbohydrates on whose diastatic changes manganese exerts a beneficial influence. With nitrogenous manures another two different observations were made : (1) that the crops receiving crude calcium cyanamide in the absence of manganese were very poor, while in the presence of manganese they exceeded those obtained even with $(NH_4)_2 SO_4$. $NaNO_3$ manganese, and (2) that the poisonous action of guanadine nitrate was completely stopped by manganese. Also calcium, magnesium and potassium salts as well as phosphatic manures were investigated. In distinction to the experiments in water cultures it was found that on alkaline garden-soil KCl acted as a preventive, while potassium silicate, mono- di- and tricalcium phosphates increased the liability of the plant to the disease, but this is to be expected, since they increased the physiological alkalinity of the garden soil. Magnesium sulphate reacted favorably in distinction to the carbonate, $CaCl_2$ acted as a preventive, $CaHPO_4$ diminished the danger of "Dörrflecken" formation Interesting was the observation that a 14 cm. thick layer of lime under 13 cm. of garden soil prevented the appearance of the disease, another proof that neither lime itself, nor an alkaline reaction by itself, can be considered as sufficient cause for the appearance of the disease. From among the phosphatic manures Rhenania-phosphate was the most poisonous, although even in the presence of superphosphate, crude phosphate or basic slag the disease appeared and usually in two phases. The manganese acted beneficially in each case, most in the case of Rhenania phosphate, least in the case of superphosphate.

The open field experiments were primarily qualitative experiments, and they proved that the degradation processes and the greater liability to the "Dörrflecken" disease, which is noticed in the case of mountain varieties of oats when grown in other suitable places, is transferred also to the seed. The action of the manganese depended to a large extent on the different environmental influences extended on the plant. The liability to the disease is also conditioned by all the influences exerted on the development of the seed.

The question whether the action of the manganese is due to its influencing the processes taking place inside the plant or in the soil, was answered by the following experiment. A plant grown in a nutrient solution containing manganese sulphate was transferred to a soil from which manganese was completely absent and yet showed no signs of acquiring the disease. This shows unmistakably that the manganese has some influence on the processes taking place inside the plant. In the above experiment the manganese must have reached the leaves of the plant in

the early stages and remained there. The same beneficial results were achieved on painting the " Dörrflecken " leaves with manganese sulphate solution, especially if $FeSO_4$ was supplied at the same time.

In the diseased leaves the internal processes were found to have a considerable increase in the peroxydase content, while in the case of healthy leaves a preponderating amount of catalase was found. In the latter a peroxydase fever could be artificially produced by manganese. In view of this it is reasonable to assume that in the case of formation of injurious substances these are immediately oxidised. These injurious substances are formed readiest in the so-called " second youth stage " of oats, between the stages of " stemming " and " shooting forth ", and in this stage the formation of the very strong secondary roots takes place. Because of this the plant has soon available about ten times the mass of roots of either wheat or rye, and is capable therefore of withdrawing from the soil nearly double the amount of nitrogen as is withdrawn for example by barley, and in this way it can store up, already in the first four weeks, 10 % of its dry weight and about 25 % of its final ash weight. If this is so, the equilibrium between root and leaf nourishment is easily disturbed, which is followed by the formation of injurious substances in the leaves The deficiency of nutrient salts in young plants, accelerates flowering and prevents the appearance of the disease. The same thing might be observed in young plants if they were supplied with carbonic acid which could absolutely replace manganese in its action. Hence the fact, actually observed, that all climatic influences which increase assimilation (light, CO_2) cause a diminution in the liability to the disease and the action of manganese and vice versa, and also that increased transpiration, with an accompanying increased supply of soil nourishment, if not followed by increased CO_2-assimilation leads to a readier appearance of the disease and increased action of manganese. Salts reacting on the leaves which, on account of a shortage of carbohydrates, cannot be used up, begin to act as obstructing substances in the generative stage of oats, and lead to the appearance of the disease, while all causes which accelerate the flowering and among them a carbohydrate excess, lead to the disappearance of the disease.

The beneficent action of the manganese the author explains by assuming that its presence causes an increased CO_2-assimilation. His conclusion he embodies in the following "carbonic acid mineral matter law" : " If the plant is to attain the best health and if no disturbance is to take place in the equilibrium of the chemical compounds necessary for its formation, an increased supply of soil-nourishment has to be accompanied by an increased CO_2-assimilation. If conditions of weather, light and especially heavier artificial manuring do not permit the bringing about of these optimum conditions, then disease sets in, which under certain circumstances is transferred to the seed ". In the case of such nutritive disturbances a manganese fertiliser acts very beneficially, heating, stimulating growth and enabling the plant to make the fullest use of the soil nourishment.

E. V.

Plant Parasites.

210. **The " Peronospora of the Hop " (*Pseudoperonospora Humuli*) reported in Wurtemberg, Saxony, Bohemia and Alsace** (1)

LANG W. Der falsche Mehltau am Hopfen. *Nachrichtenblatt für den deutschen Pflanzenschutzdienst*, Year 5th, No. 8, pp. 63-64. Berlin, 1925.

In Wurtemberg, and particularly for the first time during July 1924 in the district of Tettnang, and in the middle of June 1925 here as also in the great hop district, which extends from Horb to Herrenberg, was reported the rapid spreading of the " peronospora of the hop " (*Pseudoperonospora Humuli* (Myabe and Takah.) Wils.

Also in 1925, equally intense attacks of the disease were recorded in Bavaria, Bohemia and Alsace.

Against this disease, which may constitute a serious danger to hop growing, treatment with copper solutions is recommended, carried out at suitable periods. G. T.

211. ***Alternaria Fici*, Hyphomycete injurious to the Fig, in Piedmont.**

GHIRLANDA C. Sopra una malattia del Fico. *Annali della R. Accademia d'Agricoltura di Torino*, Vol. LXVII (1924), pp. 71-76, 2 fig. Turin, 1925.

At Turin at the end of August 1923, the author observed for the first time an abundant fall of young receptacles (syconiae) from a fig tree (referable to var. " Troiano " also called the " Livia " fig), which otherwise appeared to be quite healthy. The small fallen receptacles, which were deformed by irregular growth, showed, on one side only, a large rounded spot, depressed, edged with a pad of darker colour than the surrounding zones. In the syconiae in which the disease had made most progress the spot was to a great extent covered with a slender velvety down of a rather dark olive-brown colour. Microscopic examination of such down revealed the presence of a Hyphomycete, classified by the author as *Alternaria Fici*, already described by R FARNETI as carrier of the " atrophy of the fruit of the fig-tree ", a disease found by him for the first time in the Province of Pavia.

Contrary to the observations of FARNETI, the author found that the mycelium of this species of the Dematiaceae not only invades the tissues of the mature receptacles, but is constantly present also in the small fallen syconiae.

The author has easily made an artificial culture of the parasite. This, taken from a pure culture and from infected receptacles, was inoculated, with positive results, on sound syconiae. Two successive treatments, made at an interval of twelve days, one after another, with neutral Bordeaux mixture, at strengths of 0.5 and 1. % respectively, arrested infection, allowing perfect ripening of the few receptacles remaining on the tree. In February 1924, the author also carried out a winter treatment with mixture at a strength of 2.5 %, after which the tree was in a very good condition of growth. G. T.

(1) See also *R.* 1923, No. 810. (*Ed.*)

212. **The "Ink Disease" of the Chestnut (*Blepharospora cambivora*), in Corsica.**

DUFFRENOY J. Maladie des Châtaigniers en Corse. *Revue des Eaux et Forêts*, Vol. LXIII, VIth. Ser. Year 23, No. 4, pp. 149-156, 6 fig. Paris, 1925.

For at least twenty years, apparently, the "mal dell'inchiostro" (*Blepharospora cambivora* Petri) has attacked chestnut trees, in Corsica.

It appears that the disease was first observed at Corte whence it very soon spread to the Venaco district, causing the disappearance of the chestnut woods affected.

As regards curative treatment of the diseased trees, in 1923 at Saint-Pierre-de-Venaco, a deep wide notch was cut with an adze near the base of the trunk of a dying chestnut tree; in the spring of 1924 the production of very green and rather abundant foliage was noticed.

At Murato another experiment was made: — all the blackened tissues of the base of the trunk, the collar and the large roots, were removed with the adze; an operation which, according to the author, should be extended to all the trees attacked in the same chestnut wood.

Since the chestnut trees operated on remain exposed to reinfection, it is indispensable to supplement this surgical treatment with a disinfection of the soil with cupric salts. It would also be useful to spread nitrogenous, potassic and phosphatic salts at the roots of the trees.

It appears however better: to fell as soon as possible trees found to be attacked in the middle of a sound chestnut wood, and also to fell, as a precaution, their immediate neighbours, which may be infected without showing symptoms of the disease; to disinfect with cupric salts the stumps and the area where they stood; to disinfect as a preventive the soil at the base of the still sound chestnuts standing near. G. T.

Animal Parasites.

213. **New species of Curculionidae Beetles injurious to Cultivated Plants in Various Countries.**

MARSHALL G. A. K. *Bulletin of Entomological Research*, Vol. XVI, Part 1, pp. 67-75, fig. 2 tab. 1. London, 1925.

Description of the following. Curculionidae beetles: —

(1) *Protostrophus edax* n. sp, injurious to young cotton plants in the Transvaal (White River).

(2) *Prot. lugubris* n. sp., considered injurious to young cotton plants in Natal (Esperanza).

(3) *Prot. mutator* n. sp., injurious to beans in the Cape Province (Somerset East).

(4) *Prot. vorax* n. sp., the adult beetles have damaged young cotton plants in the Transvaal (Rustenburg).

(5) *Prot. rotundus* n. sp., has completely destroyed 200 acres of maize and 50 acres of millet in the Transvaal.

(6) *Mecostylus acuminatus* n. sp., living on the leaves of the coffee shrub in Kenya (Teita Hills, near Voi).

(7) *Sympiezotrachelus impar*, n. sp., the adults have been found on the leaves of sugar cane in Natal (Mount Edgecombe).

(8) *Echinocnemus oryzae* n.sp., the larva feeds on the rootlets of the rice plant in Madras (Kaikalur, Krishna district; Samalkot; Thurumella, Guntur district).

(9) *Anthonomus cyprius* n. sp., bred on peach buds in the Island of Cyprus. G. T.

214. **New Curculionidae attacking Trees in India.**

MARSHALL G. A. K. *Bulletin of Entomological Research*, Vol. XV, part 4, pp. 339-344, 1 table, London, 1925

Description of the following species of Curculionid Coleoptera :

(1) *Corigetus instabilis* n. sp. The adults were found attacking the leaves of *Casuarina equisetifolia* trees in Kanara (Bombay)

(2) *Magdalis hymalayana* n. sp., observed in different parts of the United Provinces (Dharmoli, Kumaon, Kanasar, Chakrata) ; the specimens from Kanasar were obtained from *Pinus longifolia* ;

(3) *Camptorrhinus mangiferae*, n. sp., observed in Bihar and Orissa (Koina-River, Singbhum) , the insect was found on mango trees (*Mangifera indica*) ;

(4) *Phylaitis pterospermi* n. sp., observed in the United Provinces (Golatappar, Dehra Dun) , obtained from the wood of the *Pterospermum acerifolium* ;

(5) *P. scutellaris* n. sp., observed in the United Provinces (Riverain Forest, Nagsidh, Dehra, Dun), where it was found on *Eugenia Jambolana* ; Lachiwala Range (Dehra Dun), where it was found on *Acacia pennata* ; in Bombay Presidency, at Kasik where it was reared on the *Cassia auriculata*. G. T.

215 **Rhyncotes of the Island of Cuba.**

METCALF Z. P. and BRUNER S. C. Notes and Descriptions of the Cercopidae of Cuba. *Psyche*, Vol XXXII, No. 2, pp. 95-105. Boston, Mass, 1925,

This is the first of a series of works on the *Homoptera* (sub-order of the Rhyncotes) collected during the last eight years in various localities in the Island of Cuba, by BRUNER, of the Agricultural Experimental Station of Santiago de las Vegas.

Fifteen species and one variety belonging of the family *Cercopidae* are dealt with in it. One genus (*Dasyoptera*) and twelve species (*D. variegata*, *Monecphora flavifascia*, *Leocomia grisea*, *L. balloni*, *L. nagua*, *L. maestralis*, *L. pileae*, *L. fulva*, *Enocomia maestralis*, *Lepyronia robusta*, *Clastoptera flavidorsa* and *C. cuba*) are described as new to science.

It is to be noted that *Monecphora bicincta* Say var. *fraterna* Uhler (= *M. fraterna* Uhler), common in the Island, damages *Panicum numidianum* (popularly called " Parana ") and sometimes attacks sugar cane. *M. flavifascia* n. sp. may prove important from an economical point of view as a pest of sugarcane. G. T.

216. ***Eburia quadrigeminata*, a Coleopteron of North America reported in Algiers.**

BALACHOWSKY A. Note sur la présence accidentelle de l'*Eburia quadrigeminata* (Say, 1827) Coléoptère Cerambycide de l'Amérique du Nord à Alger. *Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord,* Vol. XVI, No. *LLL*, p. 107. Algiers, 1925.

In June, 1924, there was captured at Algiers an individual of *Eburia quadrigeminata* Say, a *Cerambycidae* Coleopteron long known in the United States and Canada, where its larva lives, boring galleries in the wood of oak, chestnut and ash trees.

The presence of the insect in Algiers is altogether exceptional: in the author's opinion it has certainly been introduced by means of American woods; it seems very improbable that the species can continue to exist in that Colony. G. T.

217. **Observations made in England regarding the Cherry Black Fly (*Myzus cerasi*).**

WIMSHURST F. M. *Bulletin of Entomological Research,* Vol. XVI, Part 1, pp. 85-94, fig. 6. London, 1925.

Though *Myzus cerasi* shows itself to be sometimes a serious pest of the cherry and has therefore acquired economic importance in Great Britain, its biology has not yet been completely studied in the eastern hemisphere. The author gives in the present work a systematic description of the forms of the insect found in Kent (England) -- where this Aphid lives on *Galium Aparine* as well as on the cherry — it is an account of biological observations made there during two years on *M. cerasi*. There follows a list of natural enemies of the latter, observed by the author in the above mentioned district. G. T.

218. ***Aphis leguminosae*, Agent of Transmission of a "Rosette" Disease of the Ground Nut, in South Africa.**

STOREY H. H. and BOTTOMLEY A. M. *Nature*, Vol. 116, No 2907, pp. 97-98. London, 1925.

During recent years the cultivation of the ground nut (*Arachis hypogaea*), in certain localities of South Africa has been seriously affected by the appearance of a disease, locally known under the name of "Rosette". The leaves of the plants affected are small, contorted, closely congested owing to lack of elongation of the stalk, generally yellow, and in many cases showing well defined variegations. No seed is borne by a plant diseased in the first stage of growth and the crop is materially reduced by a late infection.

The nature of this disease remained obscure for a long time. Recently pathologists have generally admitted that the "rosette" of the ground nut belonged to the virus group of diseases. In support of this view now comes in the experimental transmission of the disease: researches carried out at Pretoria and at Durban, have proved the capacity of *Aphis leguminosae* Theo. for transmitting the disease.

In these experiments, specimens of the Aphid taken on plants affected with " Rosette ", were placed to feed on a single mature leaf of a healthy plant, suitably protected from attacks of all other insects. The characteristic symptoms of " Rosette " then appeared in the young leaves of a great number of these plants. The control plants, treated in an identical manner but protected from the attack of insects, remained perfectly healthy.

During these researches a collection was made of all sucking insects present in the field on the diseased ground nut plants. Experiments made with over two hundred specimens of Jassidae and Fulgoridae, belonging to at least eight species, have not enabled even one case of infection to be obtained on the plants subjected to the experiment. G. T.

219 **Ants Injurious to the " Stick-Lac " Cochineal Insect in Cambodia.**

BATHELLIER J. Observations sur les prédateurs des cochenilles à stick-lac. *Bulletin économique de l'Indochine*, New Series, 29th Year, No 170, pp 59-66. Hanoi, 1925.

Three species of ants are serious enemies to the cochineal insect, which produces stick-lac, in Cambodia. The author has been able to identify them as: (1) *Crematogaster walshi* Forel, of the subfamily of *Myrmicinae*: this is the most injurious, and is called by the Cambodians " tailed ant "; (2) *Camponotus* sp. also very injurious, (3) *C. rufuglaucus* Jordon, of the sub-family of *Camponotinae*.

Oecophylla smaragdina F. protects the cochineal insect against the attacks of the other ants.

In order to prevent the damage caused by the latter, the author commends the smearing of gluey solutions around the trunk of the trees on which the " stick-lac " cochineal insect is reared. P. C.

220. ***Gracilaria zachrysa*, Microlepidopter injurious to Azaleas in France.**

LE MARCHAND S. Note sur la présence en France de *Gracilaria zachrysa* Meyrick, Microlépidoptère exotique, nuisible aux Azalées *Bulletin de la Société entomologique de France*, No. 9, pp. 146-150. Paris, 1925.

Gracilaria zachrysa Meyr., described in 1907 as a native species of Ceylon, was observed in 1912 in Holland, and in the following year in Belgium, on Azaleas (particularly *Azalea indica*) imported from Japan. In consequence, the presence of the Microlepidopteron was noted in only three Departments in France on azaleas sent from Belgium to Saint-Saens (Seine-Inférieure) some years ago, at Paris (Seine) and at Bayeux (Calvados) in January 1925. But it may be presumed that the species is already fairly common in France. The azaleas sold there by horticulturists come almost exclusively from Belgium, where they are grown on a large scale. It is therefore possible that wherever in France azaleas have been received from Belgium, this insect will be found in smaller or larger numbers.

The caterpillar of *G. zachrysa* attacks the host plant and sometimes disfigures it considerably, boring galleries in the leaves, bending or actually twisting the margins or the end of the leaf.

The observations made by the author regarding the morphology and biology of the insect are described. G. T.

221. ***Coelaenomenodera elaeidis*, a Beetle injurious to the Oil Palm (*Elaeis guineensis*), on the Gold Coast (West Africa)** (1).

COTTERELL G. S. The Hispid Leaf miner (*Coelaenomenodera elaeidis*, Maul) of the Oil Palm (*Elaeis guineensis* Jacq.) on the Gold Coast. *Bulletin of Entomological Research*, Vol. XVI, Part 1, pp. 77-83, fig. 5. London, 1925.

The Oil Palm (*Elaeis guineensis*), at intervals in various parts of the Gold Coast, has suffered from attacks of the beetle *Coelaenomenodera elaeidis* Maul. (fam. Hispidae).

This beetle was noted for the first time in this Colony in 1909-1920, but the damage of the parasite was arrested by the sudden arrival of the rainy season. It was again observed as injurious in 1919; then again the rainy season put an end to its damage. Fresh attacks occurred in 1923 and lasted until January 1924, when they were arrested by natural causes.

The insect attacks oil palms of all ages except those under three or four years. The young fronds of the host plant are attacked almost before they unfold and the larva of the beetle bores galleries under the epidermis. The young fronds are very soon corroded and torn from the rachis by the wind.

A badly attacked palm has an aspect similar to that of a plant which has suffered from the action of fire. Naturally, consequent on the attack, the product of the palm is reduced and the palm itself loses vigour. The larvae of *C. elaeidis* live also at the expense of the coconut palm, *Borassus*, and some ornamental palms. The adult insects also feed on these, and still other plants; they attack the lower surface of the young fronds of the oil palm, devouring the parenchyma between the nerves and leave brown longitudinal incisions on the fronds themselves. Observations made at the Aburi Agricultural Station regarding the biolology of the beetle are separately reported by the author. Its complete cycle of development occupies about thirteen or fourteen weeks.

Four Hymenoptera (fam. *Eulophidae*) natural enemies of *C. elaeidis* were obtained by breeding, namely, *Closterocerus africanus* Wtstn. and *Achrysocharis leptocerus* Wtstn. parasites on the egg, *Dimmockia aburiana* Wtstn. parasites of the larvae. The two latter are in turn preyed on by a Hymenopteron belonging to the same fam. *Eulophidae* (*Pleurotropis nigripes* Wtstn). *C. elaeidis* is also attacked in nature by parasitic fungi which are common on account of the great humidity. The rain also serves as a check on the development of the beetle, which owing to the high numbers of its parasites is not likely to become a real scourge for oil palms.

In the present conditions of the Colony the application of artificial measures of control against *C. elaeidis* is not possible. G. T.

(1) See also *R.* 1920, No. 605. (*Ed.*).

CURRENT NOTICES

Legislative and Administrative Measures.

222. **Legislation with respect to the Importation and Exportation of Plants in Various States.** — The Legislative Section of the International Institute of Agriculture sets forth by means of a short series of publications, the current legislation passed in the various States for regulating the importation, exportation and transport of plants. Each monograph deals first with the legislative sources of the information in question, and then goes on to deal with the organisation of the national services responsible for the application of the measures in question. (*Institut International d'Agriculture. Exposé de la Legislation relative à l'importation et à l'exportation des plantes*).

223. **Austria: Regulation of the Trade in Chemical Fertilisers.** — To meet the difficulties of the marketing of these fertilisers and to protect the farmer against commercial frauds, the Federal Minister of Agriculture and Forestry for Austria has issued a decree which lays down special rules for the trade in the products in question The terms of the decree cover all materials which are not the immediate product of the farm, but which on account of their content in nitrogen, phosphoric acid, potash, lime and other chemical constituents are placed on the market as artificial fertilisers. These artificial manures may be put up for sale only after declaration of their properties and of the weight of their effective chemical constituents. Generally speaking the declaration, in addition to the usual commercial indications, must contain information on the value in fertilising substances and on the form in which they are found in the products as placed on the market.

In the case of calcareous fertilisers the grade of fineness must also be indicated and in that of fertilising mixtures, the nature of the blend and the form under which the effective constituents are present. In the case of those products that are placed on the market with the indication that, in addition to their usual commercial value, they are in some special way favourable to plant development, the nature and character of this particular action must be clearly indicated.

Declarations are regarded as valid if the differences do not exceed one per cent. and in the case of nitrogenous fertilisers one half per cent. of the true content in fertilising substances.

The political and district authorities and the Agricultural Experiment Stations are responsible for supervising the application of the measures enacted. The Stations are also authorised to take samples for analysis and to make

use of a staff sworn in for the purpose and subjected to professional secrecy. (*Bundesgesetzblatt*, No 88, 1925).

224. **Austria: Regulation of the Trade in Forest Seeds.** — With the object of protecting trade in these seeds, the Austrian Federal Ministry of Agriculture and Forestry has published an order placing the trade under certain restrictions and making compulsory the declaration of the origin of the seeds offered for sale. The order relates to the seeds of the most important forest species. Within the area of the Federal territory the seeds can only be transported in sealed packets and accompanied by a statement of all data required, in particular of the kind of the seeds, their weight and the time at which they were gathered. In addition for the oaks and the conifers statements must also be made as to the percentage of germinability and purity, and of place of origin In the case of certain forest species special declarations are also required as to the conditions of the soil in the place of origin and on the actual origin of the seeds. (*Bundesgesetzblatt*, No. 249, 1925).

225. **Brazil : Exemption from State Taxes in the State of Bahia for Producers of Oil-seeds, resins and wax and for cotton cloth factories.** — The following are exempted from all State taxes, with the exception of the territorial tax, for ten years from 7 August 1925 : 1 All factories set up for the utilisation of oil seeds, of animal and vegetable wax and resins, for the manufacture of oils of vegetable butters and margarine, and for the improvement of such products and the utilisation of the by-products. 2. All cotton cloth factories, set up in the State cotton centres, provided that at least half of the raw material utilised is produced within the State This exemption is also extended to the buildings, vehicles and raw materials, etc. in use. (*Boletim do Ministerio da Agricultura, Industria e Commercio*, September 1925, Rio de Janeiro)

226 **Brazil: Concession of Lands for Rubber Cultivation in the State of Parà.** — A State decree has been issued for encouraging improvement of lands by means of agreements with capitalists and manufacturers, and for the concession of the free utilisation of lands intended for rubber cultivation, up to a maximum of 150,000 hectares per lot, and for the period required for the manufacture. The lands so granted shall become the absolute property of the grantee, as soon as they are growing more than 100,000 plants of at least five years of age and producing rubber. The State Government is empowered to make other grants of lands intended for the utilisation of the raw materials native to Parà, and for the cultivation of plants of economic value. The area of such concessions must not exceed 50,000 hectares (*Brasil-Ferro-Carril*, Year XVI, No. 429, 1925).

227. **Spain: Stabilisation of the Grain Market.** — The Ministry of Fomento, with the object of stabilising the national grain market, preventing speculation in grain and enabling farmers to keep it under normal conditions up to the time of the actual sale, has just authorised, in connection with the harvest of 1925, the making of loans to the farmers for an amount equal to half the value of the grain which they have deposited in pledge. A sum of 50,000,000 pesetas is set aside for the purposes of these loans. (*Gaceta de Madrid*, No. 188, 1925).

228. **Finland : Measures for Plant Protection.** — The Ministry of Agriculture of Finland has assumed control of the importation, transit conveyance through the country, cultivation, transportation as also trade in plants or parts of plants infected with pests, or liable to spread infection. These measures are contained in a law of June 1925, and are accompanied by a decree specifying the plant pests which come under this control, and the regulations referring to the control. These regulations also define the procedure for fixing the compensation in the case of any necessary destruction of infected vegetable matter.

229. **France : Phytopathological Inspection of Farm Establishments.** — Under these regulations, all horticultural and viticultural establishments as well as establishments for the export of agricultural products have been assigned, taking into consideration any previous decrees, among the twenty seven existing areas for phytopathological control. (*Journal Officiel*, 5 January 1926).

230. **France (Regency of Tunis): Measures for the Protection of Growing Crops against Animal and Plant Parasites.** — Amendments have been introduced into the first two articles of the Decree of the Regency, 25 January 1922, and in virtue of these amendments every owner of lands or cultivator must notify the local administrative authorities of any damage done to the crops by parasites, and the Director General of Agriculture, of receiving information from these authorities, may order measures to be taken immediately for the protection of such crops, either destruction of the parasitic pests or destruction of the infected plants, restriction or prohibition of transport of plants or parts of plants which may be the carriers of infection or infestation, etc The Service of Plant Protection supervises the application of the measures thus prescribed. (*Journal Officiel Tunisien*, No. 46, 1925)

231. **France (Regency of Tunis) : Provisions for Agricultural Credit.** — These provisions are contained in two decrees. By means of one, a public office for agricultural credit is instituted, administered by a Board of Directors and under the control of the Director of the Agricultural Services and of Instruction. This office is empowered to make loans for agricultural improvements, both seasonal loans and loans for long periods By the terms of the second decree loans are made for long periods in favour of agriculturists who are disabled ex-service men. (*Journal Officiel Tunisien*, Nos 55, 60, 1925).

232 **Canada : Grain Legislation.** — All trading questions relating to grain have been regulated in considerable detail by the Canadian Government in a law, consisting of 236 articles and divided into four parts, with the short title: 'Canada Grain Act'. A Board of Grain Commissioners is established which within thirty days of the close of the civil year must present a report to the Ministry of Commerce : (*a*) on all matters in connection with the inspection, weighing, storage and transportation of grain ; (*b*) on such matters as the Ministry may direct. Under separate headings are set out the duties of inspectors, commercial grades, the grain standards board, the grain survey board : provisions relating to sales, to fees, weighmasters, of-

fences, procedure, Eastern and Western Inspection Divisions, grain from the United States.

One whole part of the law (Part III) is given up to the Western Inspection District (provinces of Manitoba, Saskatchewan, Alberta, British Columbia, North-West Territory, and that part of Ontario that lies to the west of Port Arthur) and deals with the public and private elevators and all operations connected with them, loading platforms, railway cars, commission merchants, etc. (*Statutes of Canada* 15-16 Geo. V., Vols. I-II, 1925: *International Institute of Agriculture, Texts of Laws*, No. 20, 1925).

233. **Union of South Africa: Control of the Export of Fruit and of the Shipment of Fruit at the Union Ports.** — The institution of a Board of Control for this purpose has been authorised by law, such Board to be appointed by the Governor General with the following duties: (*a*) to control the export of fruit and the orders of shipment of fruit at all ports of the Union, (*b*) to call for and to receive from fruit producers estimates and other particulars of their intended exports; (*c*) to call for and to receive from shipowners information respecting the amount of space available on any ship appointed to call at any port of the Union; (*d*) to perform such other functions in respect of the export and shipment of fruit from the Union as may be prescribed by regulation. (*Government Gazette Extraordinary*, No. 1477, 1925).

234. **Union of South Africa: Care of Orchards in South Africa.** — The Governor General of the Union of South Africa has issued a series of measures (*Government Gazette Extraordinary*, No. 1477, 1925) under which every owner of an orchard is required to cleanse such orchard from insect pests. In the event of non-compliance the cleansing is carried out officially by the competent authorities. The Governor General may in case of need also prescribe the technical methods to be followed in such cleansing.

235. **Union of South Africa: Promotion of the Agricultural Industries.** — With this object certain fiscal charges have been introduced which, under certain conditions, shall be imposed on agricultural products, and the receipts from which shall be employed to promote: (*a*) experiments, enquiries, or the diffusion of agricultural information in respect of them; (*b*) the erection or purchase of buildings, lands, live stock, machinery, implements or requisites in view of the objects indicated in paragraph (*a*); (*c*) the most profitable method of sale of produce; (*d*) any other subsidiary to the purposes contemplated in paragraphs *a*, *b*, *c*; and finally (*e*) any further aid which in the opinion of the Minister of Agriculture is required for the advancement of agriculture. (*The Union of South Africa Government Gazette Extraordinary*, No. 1489, 1925).

236 **Union of South Africa: Regulation of the sale by public auction as well as certain transactions in livestock, and other agricultural products.** — The rules issued constitute a regulation of sales by auction or sales not effected by private treaty of live stock, wool, hides, mohair, shins, cotton, sugar and other products of sugar cane, and ostrich feathers. (*The Union of South Africa Government Gazette Extraordinary*, No. 1493, 1925).

237. **Irish Free State: Law on Breeding of Cattle.** — In a series of articles strict regulations are laid down as regards breeding arrangements which

can only be carried out after a permit has been obtained from the Ministry of Agriculture. This permit is only given after taking the opinion of an expert committee. (*International Institute of Agriculture. Texts of Laws*, 1925, No. 32).

238. **Italy : Measures for the Repression of Fraud in the Preparation and Trade in the substances employed in agriculture, and in that of agricultural products.** — In different chapters of a Decree Law published in No. 281 of the *Gazzetta Ufficiale* of 1925 there are contained measures for the repression of frauds in fertilisers, spraying and dusting materials, forage and seeds · in wines, vineyard ; oils ; in butter and lard , in cheeses ; in syrups and preserves

239. **Italy : Measures for the Protection of Apiculture.** — Under a decree law the formation of provincial consortia is being contemplated, consisting of owners of hives, supported if necessary by the Provincial Agricultural Councils and in case of need made compulsory whenever apiculture has in any given province special importance. These consortia may in their turn be linked up with larger interprovincial consortia within the area of the same region. Their main work will be the supervision through specially appointed experts, of all matters connected with the control of bee diseases and pests , the diffusion among agriculturists of the knowledge of the proper measures of control , the diffusion of the regional methods for bee-keeping, with special attention to the purity and careful selection of Ligurian bees ; the protection of the economic interests of the apiculturists, of the trade and industry in bee-keeping, and the taking of steps to prevent frauds

The Decree law lays down regulations as regards prophylactic measures and the control of the infectious diseases of bees, ordering in case of need the destruction of hives and of infected utensils No compensation is due to the apiculturists in respect of such destruction, but the consortia may guarantee a partial compensation payment, under the form of insurance A special article deals with the trade in honey and in this connection provision is made for the taking of samples to establish purity by means of analysis. (*Gazzetta Ufficiale*, No. 281, 1925)

240. **Italy (Eritrea) . Regulations for Cotton-Growing.** — The Governor of this Colony, by the decree of 22 June 1925, enacts that in certain zones of the Western and Eastern lowlands the cotton plants must be grubbed up and destroyed by fire as soon as the picking is over. The Agricultural Office will each year fix the date by which the fields must be cleared of the residues of the crop. In the case of non compliance by the grower, the Government will undertake the clearing of the fields at the expense of the growers.

241. **Japan : Breeding of Cattle.** — In the official Japanese Gazette, *Kwampô*, a law was published in June 1925, on the free loaning of service bulls by the Zootechnical Experiment Stations (*Chikusanshikenjô*), with the object of promoting the improvement and diffusion of the breeds of cattle. The loan is made to the prefecture, to the breed associations (*chikusan-Kumiai*) and to the federations of these associations (*chikusan-Kumiai rengôkwai*).

242. **Japan : Order relating to the Establishment of the Ministry of Agriculture and Forests.** — These are contained in *Kwampô*,

No. 3779, 1925. In virtue of this order the Ministry of Agriculture and Commerce is abolished and there is created a Ministry of Agriculture and Forestry, including four general departments: agriculture (*nômul-Kyoku*), animal husbandry (*chikusan-Kyoku*), forests (*sangin-Kyoku*) and water cultivation (*suisan-Kyoku*). The Ministry has power to set up special offices for rice cultivation (*beikoku-jimusha*) in the localities in which it is deemed necessary. The General Department for agriculture includes the following sections. agricultural policy, agricultural production, sericulture, agricultural industries, co-operation, cultivated lands, rice cultivation, accounting. The Forestry Department includes two sections: forestry administration and sylviculture; that of water cultivation also two sections. fisheries and aquatic production; the Zootechnical Department three sections zootechnical policy, horse breeding, cattle breeding. (*International Institute of Agriculture. Texts of Laws*, No 8, 1925).

243. **Switzerland: Encouragement of Cereal Cultivation.** — The Federal Bank supplies the funds for the milling premiums established by the Federal Decree of 20 June 1924, which annuls the former Federal Decree of 1 July 1922 intended to encourage the cultivation of cereals Every producer in Switzerland, who uses cereals grown by himself for the feeding of his own family in bread and flour, has the right to a milling premium of 5 francs per 100 kg of grain (wheat, rye, spelt, maize, and in the mountain districts, barley). For the mountain distriest, i e 800 metres and upwards, the premium is increased by an extra sum which may amount to a maximum of 3 francs per quintal of grain For the purposes of the premium the gleaners are reckoned as direct producers Producers wishing to benefit by this measure or to surrender on favourable terms the quantities of grain which are in excess of their domestic needs, as also the millers who grind the grains in respect of which the premium is paid, must allow the inspecting bodies of the Federal Grain Control free access to the warehouses or farm premises Whenever the producer wishes to sell to the Government, on favourable terms, the surplus of his domestic requirements in grain, he must first of all provide on general lines for these requirements, making use of the grain which he has himself grown. (*Recueil des Lois Fédérales*, No. 9 and 16, 1925).

244. **Switzerland: Legislative Measures on Sport and the Protection of Birds.** — These are contained in a Federal Law of 10 June 1925 and in regulations for its application issued on 25 November of the same year. Under separate headings the following subjects are dealt with: sporting rights, the practice of shooting, etc, the species of birds, etc., protected, periods for shooting in the localities for which permits may be given, periods for shooting on land rented for shooting. protection of wild animals and birds, protection against losses caused by wild animals, police rules, penalties, temporary and permanent provisions.

The regulations came into force on 1 January 1926 (*Recueil des Lois Fédérales*, No. 32, 1925).

245. **Switzerland: Regulations for preventing the Contamination of Water Courses.** — Special provisions in connection with the Federal law on fisheries of 21 December 1888, have been issued in Switzerland under which it is absolutely forbidden to place in waters populated by fish refuse

matter likely in any way to injure the fish and to prevent their propagation. Solid and liquid waste material coming from farms of any kind cannot be placed in such water courses unless a permit has previously been obtained from the Competent Cantonal Authority as well as approval from the Federal Department for the Interior. Permits cannot be obtained in respect of waste water until they have been purified by suitable processes such as sedimentation, filtration, precipitation, dilution or biological processes, prescribed by and under the inspection of the authority mentioned. This body will determine the measures of protection to be applied in the case of industrial canals communicating with public water stocked with fish and in any case any fishery rights which may exist in regard to the canal waters in question are taken into account The above mentioned provisions came into force from 1st June 1925. (*Recueil des Lois Fédérales*, No. 11, 1925)

Experiment Stations and Agricultural Instruction.

246 **Argentina : The Agricultural Information and Propaganda Service at the Ministry of Agriculture.** – This service issues propaganda leaflets which are sent to agriculturists who make application on a special form to the *Ministerio de Agricultura, Sede de Propaganda e Informes, Paseo Colon 974, Buenos Aires* They can at the same time apply for the publications which refer to the crops as shown in the form and which are grown by the applicant The Service periodically publishes the list of its propaganda

247 **Spain : Encouragement of Enquiries into the Prevention and Cure of the Chestnut Tree Disease at Estremadura.** *La Real Academia de Ciencias Exactas, Fisicas y Naturales de España*, in accordance with a request made by D VINCENTE PAREDES GUILLÉN, has announced a public competition on the prevention and cure of this disease A prize of 38,934.75 pesetas is to be awarded and was placed in December 1924 in the Plasencia Savings Bank, and will be increased by interest at 3 % from that date up to the time of the adjudication of the competition

Theses must be addressed to the above Academy which naturally reserves the right of proceeding to practical demonstrations as to the methods of prevention and cure described before proceeding to make the award (Communicated to the International Institute of Agriculture)

248. **United States : The fifteenth anniversary of the Connecticut Agricultural Experiment Station :** – This anniversary was celebrated on 12 October 1925 at Newhaven in the presence among others of representatives of the other north east stations, of the Federal Department of Agriculture, of the Association of Agricultural Colleges and of the University of Yale. The Connecticut Station was the first to be founded in America and among its founders were Professor SAMUEL W. JOHNSON of Yale University and Professor W. D. ATWATER of the Wesleyan University. O. JUDD, Editor and Proprietor of the *American Agriculturists*, gave a personal contribution of 1000 dollars as a contribution to this Institution and the Wesleyan University placed at its disposal its own chemical laboratory, both these offers being made under the condition of a Government grant of 5600

dollars for the first two years. A decree of 2 July 1875 set aside this sum for the purpose and ATWATER was appointed as Director of the new station which was situated at Middletown. At the expiration of the two years a further annual and permanent grant of 5000 dollars was decreed and in this way it was possible to organise the station under Government inspection with Professor JOHNSON as Director and with headquarters at Newhaven, with the use of the laboratories of the Sheffield Scientific School.

Other States followed the example of Connecticut and in this way by means of legislative measures there were quickly established the experiment station of North Carolina (1877), of New Jersey (1880) and Massachusetts, of the New York State and of Ohio State (1882) (*Experiment Station Record*, No. 53, No. 7, Washington, 1925)

249 **United States: The Boyce Thompson Institute for Plant Research, Yonkers, N. Y.** — A note of the foundation of this Institute was given in a previous number of this Review (see Current Notices of No 2 of 1925) There have now appeared two series of publications, one entitled "Original Contributions" and the other 'Professional Papers", consisting of separate articles which have appeared in technical and commercial journals; the paging however is so arranged that the professional papers could be collected conveniently into one volume corresponding with the contributions The publications will represent the activity of the various sections of the Institute, including the sections of physics and chemistry, bio-chemistry, micro-chemistry, morphology, physiology and pathology

250. **France: Vocational School for Shepherds at Rambouillet.** — *The Bergerie Nationale* consists of an area of 250 hectares in the midst of the forest of Rambouillet and supports a pure-bred flock of Spanish merinos The first animals of this flock (315 ewes and 41 rams) were imported from the province of Leon (Spain) as early as 1786, and the breed is considered as being one of the most important wool-producing breeds in the world. A large number of the progeny of the original flock have been exported and the breed has thus been established in all the continents. The flock at Rambouillet numbers 200 ewes and 200 rams of pure strain These form three very hardy types which show resistance to all conditions of feeding and to every difference of climate

The school for shepherds, at present under the direction of Prof. A. E. HILSONT, was opened as long ago as 1874, but was closed in 1895, because the pupils, who were taken at the age of 12, were too young to gain any permanent benefit from it It was re-opened in 1922. Pupils must now be at least fifteen years old on entering, preference being given to those who have already completed their military service. The school is open from August until Christmas. The number of pupils may not exceed 15. This year the course will last 10 months so that the pupils may have practical experience in all the work connected with sheep-rearing, in shearing and in the slipping of lambs. Every day two hours and a half of theoretical instruction is given. The rest of the day is devoted to practical work among the Rambouillet merino sheep and the flocks for killing which Prof. Hilsont wishes to establish and which include already the Dishley Merinos and the Berrichons.

The course in sheep rearing is conducted by the director of the school

himself and includes the method of classification by points, feeding, the study of wool, animal husbandry, the building of sheep pens, a knowledge of sheep dogs and many other subjects. Another teacher gives lessons in veterinary medicine in its application to sheep; a third teaches French, geometry and a little arithmetic.

The head-shepherd and his two assistants undertake the practical instruction. The other part, strictly zootechnical, also includes work in wood and iron and visits to breeding pens and slaughter-houses in the neighbourhood. A Committee of inspection undertakes the general improvement of the school. At the head of this is the Inspector General of Agriculture It also includes a representative of the Colonial Department, a delegate of the Tourcoing Chamber of Commerce (one of the greatest centres of the wool-industry in the north of France) and five sheep-breeders from the five wool-producing districts of the country.

There is a museum attached to the school which contains samples of wool from all parts of the world and in particular the collection of Rambouillet wool taken regularly from ewes and rams of from 3 to 5 years of age, since 1786 (T. R. ARNOLD La Ferme et l'École nationale de bergerie de Rambouillet. *La Vie Agricole et Rurale*, Year 14, vol. XXVII, No 15. Paris 1925).

251. **France: Vocational School for Millers and Bakers.** – The object of this school which was opened in Paris on the 13th of October, 1924, under the direction of M. R WALTERSPILER, is to turn out practical workmen perfectly acquainted with the various operations of milling and mill-engineering, and capable of constructing mills and of introducing useful improvements to their own machinery *L'Association nationale de la meunerie française* met the expense of the first plant for the institution, while grants from the Undersecretaryship for Technical Instruction, subscriptions and school fees ensured its continuance During the school year, that is from October until July, lecturers of first class standing give classes in the technical process of milling (the study and classification of the various species of cereals, the art of grinding and its improvements through the centuries and the installation and equipment of the modern mill), teaching is also given in chemistry as applied to milling (the chemical components and the food value of the various parts of a grain of wheat, the division of wheat into hard and soft wheats; the definition and analysis of flour, of potato flour and of starch, etc).

Specialists in bread-making explain the physical and chemical changes set up during the process, the methods of kneading and the care of the oven. The rudiments of microbiology (moulds, fermentations, diastasis, vitamins) are imparted by biologists. Instruction is also given in entomology as applied to cereals, to flour and to bread, in the use of hydraulic motor engines, in the custom house regulations, commercial law and book-keeping. The pupils do practical work at the mill of the *Assistance Publique*, Paris and pay visits to other mills, to bakeries and to manufacturies. Examinations in these theoretical and practical studies are held regularly at the end of the school year. Successful candidates receive a diploma in mill-engineering awarded by the Undersecretaryship for Technical Instruction. In addition to the administrative offices and classrooms, the School also includes two

laboratories, one for the pupils and the other for research. The research work includes a new method of measurement of the moisture contained in a grain of corn. There is also a miniature mill, and four electrical kneading machines, each one capable of working from 2 to 3 kilograms of flour and an oven for baking bread, heated by gas and equipped with a nitrogen pyrometer according to the RICHARD system.

In the research laboratory, directed by Mlle M. T. PECAUD, studies are being made in regard to the improvement of the quality of the French wheat strains which are found unsatisfactory by bakers. (J. BOYER, L'Ecole française de meunerie. *La Nature*, No 2693. Paris, 1925).

252 **France: The New Laboratoire d'Agronomie Coloniale, at Paris.** – In a previous number of the present Review (October-December 1925, No 913), mention was made of the fire which partially destroyed this valuable laboratory. A committee to discuss reconstruction measures was quickly formed, the moving spirit being M AUGUSTE CHEVALIER, director of the Laboratoire. *L'Académie des Sciences Coloniales*, on the proposal of the president G. HANOTAUX, and of the permanent secretary, P. BOURDARIE, took the initiative of opening a subscription list for the necessary funds, in conjunction with the *Association française pour l'avancement des Sciences*. The restoration and re-equipment of the laboratory may now be said to be an accomplished fact, as a result of the work carried out with funds raised by the appeal to which there was a generous response. For the actual woodwork use was made exclusively of different kinds of tropical colonial timbers from Central Africa. It only remains to replace the scientific material, books, specimens, etc, which were so disastrously lost in the fire. Suitable publications are constantly being sent from all quarters to the new Laboratory, but the committee will gladly receive books and pamphlets dealing particularly with applied botany, botanical geography, plant selection and genetics, soil science, phytopathology, forestry, horticulture, timbers, and tropical and sub-tropical agriculture.

Donations may be sent post-free from the greater number of countries and should be addressed to M. le Ministre de l'Instruction Publique, Direction de l'Enseignement Supérieure, 2e Bureau, 110, rue de Grenoble, Paris: marked for the Laboratoire d'Agronomie Coloniale, 57 rue Cuvier, Paris (Ve).

253. **France (French Sudan): The Koutiala Experiment Farm.** – A full account of the activities of this Station, which was founded in 1923 by the French Colonial Cotton Association appears in the *Bulletin de l'Association Cotonnière Coloniale*, Year XXIII, No. 72, 1925. A number of illustrations are given.

254. **Great Britain: Publication of the Results of the Work of the Agricultural Research Institutes.** – The Ministry of Agriculture has undertaken to publish a series of monographs, the purpose of which is to give, in the language of every day life, an account of work at the Agricultural Research Institutes of Great Britain, and to explain the bearing of the results of research upon practical agriculture.

The first monograph of this series is entitled "Studies concerning the Handling of Milk" and was prepared by Dr. STENHOUSE WILLIAMS and the staff of the National Institute for Research in Dairying.

The second monograph, written by Dr. F. H. A. MARSHALL and Mr J. HAMMOND, is based upon research into the physiology of reproduction in farm animals, conducted at the Animal Nutrition Institute at Cambridge. The title of the work is 'The Physiology of Animal Breeding with Special Reference to the Problem of Fertility'. Several other monographs are in course of preparation, including one on Wheat Breeding Investigations at the Plant Breeding Institute, Cambridge, by Professor Sir ROWLAND BIFFEN (*The Journal of the Ministry of Agriculture*, Vol. XXXII, No 9, London, 1925).

255. **Great Britain: The Cotton Growing Experiment Stations in the British Possessions.** – The Empire Cotton Growing Corporation has published Reports on progress and activity in the years 1923-24-25 as regards cotton growing at the Barberton Experiment Station (South Africa), in Tanganyika Territory (Mpanganya and Morogoro Stations), in Nyasaland (Makwapala Station), and in the West Indies (St. Vincent Station).

At Barberton the experiment work was directed on the breeding of Jassid resistant cotton. Jassid, or *Chlorita fascialis*, commonly known as a leaf-hopper, is a very small winged bug which breeds on the underside of the leaf and sucks the sap. The plant is most susceptible after the earliest bolls have matured Resistant types have been raised in India, and it has been found that of the varieties imported into South Africa, the Cambodia shows complete immunity, resistance being largely dependent on the hairiness of the leaf. Experiments in hybridisation and selection are being carried out with an encouraging degree of success In Tanganyika Territory and in Nyasaland the experimental work has been of a more general character. At St. Vincent interesting variety tests have been carried out aiming at obtaining complete sets of data, as regards development, for the several varieties from the sowing of the seed up to the final production of the yarn. (*Empire Cotton Growing Corporation* 1925. *Reports from South Africa and Other Experiment Stations*, London)

256. **Great Britain: Instruction in the Fermentation Industries.** The British School of Malting and Brewing and Department of the Bio-Chemistry of Fermentation is attached to the University of Birmingham. The objects of this school are various Complete courses are given on the fermentation industries, at the end of which a certificate is granted which constitutes a qualification for chemical and bacteriological work in the branches of these industries. There is also a three year course of specialised studies, the theory and practice of brewing, malting and similar industries, at the end of which a diploma is granted. In the first year which is preparatory, instruction is given in the elements of physics, chemistry and botany, more or less comprehensive according to the knowledge of theses subjects already possessed by the students. In the second year the subjects of instruction include organic and inorganic chemistry, with the corresponding laboratory work (with volumetric and gravimetric analysis), mechanics and engineering (motor engines, steam, gas and oil, various filtration systems); geology (especially in relation to the water supply for beer factories); the first elements of the technology of brewing. The third year is devoted to a more exhaustive study of the theory and practice of the browing and malting in-

dustries, following on the fuller treatment of the different branches of biochemistry (enzymes, etc.) Special attention is given to the practical instruction in the fermentation micro-organisms and to the methods of analysis required in the industry (saccaromycetes, moulds; fermentation of the saccharoses, of the maltoses, preparation and use of the BUCHNER-zymase, lactic, butyric, acetic and viscous fermentation; causes of changes set up in the fermentation processes of beer, etc) Detailed explanations are also given of the technique of malting and brewing with accounts of the various systems in use in these industries

Short courses are also held for the benefit of those who cannot take the full three year courses, and in addition short separate courses of lectures are given as well as practical demonstrations on the principles of the industries. The school is admirably well suited to the needs of those who desire to do practical work on chemistry as applied to agriculture to elementary substance, to medicinal substances, to the provision of drinking water and in general to the principles of urban and rural hygiene

Similar courses to these held by the Birmingham School are also given in London in the Sir John Cass Technical Institute (*The University of Birmingham, The British School of Malting and Brewing, Regulations and Syllabus, 1925-26 The Sir John Cass Technical Institute, Department of the Fermentation Industries, Syllabus of Classes, Session 1925-26*)

257. **Great Britain: Organisation of Scientific Research in the British Empire.** — In the course of a speech delivered on 4 November 1925, to the Royal Society of Arts, London, Sir THOMAS HOLLAND dealt with the voluntary associations, the national associations and the overseas organisations, as well as the Imperial Bureaux, especially those of Entomology and Mycology, the Trades' Research Associations, including the Empire Cotton Growing Corporation At the conclusion of his speech the speaker emphasised the work which is being carried out by the National Research Council in the United States of America (*Journal of Royal Society of Arts*, Vol LXXIV, No 3809, London, 1925)

258 **Great Britain: A Cotton Research Station at Trinidad.** — This is to be organised by the Empire Cotton Growing Corporation at the Imperial College of Tropical Agriculture It will be adequately staffed and endowed with funds for the purposes of research into the development, under carefully controlled conditions of the cotton plant in all its phases, so as to ascertain and estimate the importance of the different factors which contribute to the final result of this development (*Nature*. Vol 116, No 2918, 1925).

259 **Great Britain: The Agricultural College at Reduit, Mauritius.** — This institution originated in the training of students at the Reduit *Station Agronomique* which was enlarged and extended to form a School of Agriculture at the time of the establishment of the Department of Agriculture in 1913. The Agricultural College is the result of the further development of this undertaking, and was inaugurated in 1923 and administered as a branch of the Department of Agriculture. The accommodation includes well equipped laboratories for the teaching of Chemistry, Physics, Botany, Entomology and Sugar Technology, a library and museum, and there are

attached experimental fields, nurseries and a stock farm. It is intended at a later date to provide facilities for practical studies in relation to sugar manufacture.

Various courses are provided by the College, usually covering a period of three years, and designed according to the special purpose the student has in view, whether to obtain a diploma in agriculture, or to become qualified as an agricultural chemist, or as a veterinary surgeon or in sugar technology. (*Colony of Mauritius, Prospectus and Syllabus of Instruction of the College of Agriculture, Mauritius*, 1924-25, Port Louis, 1924)

260. **India: Agricultural Development of the Punjab.** – Last year Sir Ganga Ram, Kt C. T. E, R B. in Lahore forwarded to the Governor of the Punjab the sum of 25,000 rupees as a fund the income from which are devoted to the award of a prize to be given every three years (*Maynard Ganga Ram* prize) for any discovery or invention or practical process which proves of value for the development of Agriculture in that vast region. The capital which is invested in the Punjab Charitable Foundations Fund is administered by a special committee The competition for the first of these prizes falls due on 1st January 1929 and is international in character. The sum to be awarded to the winner of the competition is 3,000 rupees. (Communicated to the International Institute of Agriculture by the Punjab Agricultural Department).

261. **Italy: Encouragement of the Studies of Plant Electro-Genetics.** — *L'Istituto Sperimentale di Elettrogenetica* at Belgirate, Italy, with a view to the encouragement of these enquiries, has announced for competition in 1926 three prizes of 2,500 lire each respectively for the discussion of the three following subjects: *a*) abortive embryo-genesis in the hybridisation of the Angiosperms (*b*) the origin of the false hybrids in the F, dimorphs produced by crossing among pure stocks, (*c*) double fertilisation and the formation of albumin in the hybridisation between species of the agricultural *Gramineae*.

The competition which is open to Italian citizens closes on the 31st December 1926.

262. **Italy: Encouragement of Fruit growing and Horticulture in Emilia and in Romagna.** -- The "Cesare Zucchini" Foundation (*see International Review of the Science and Practice of Agriculture* 1924, No. 690) has announced a fourth competition open to Italian citizens and public bodies for the prize of fifteen hundred lire awarded every four years for the best work, discovery, invention, scientific or industrial application of importance to the progress of fruit growing and horticulture in Emilia and Romagna.

The competition closes 31 December 1929. For information, apply: *Fondazione del premio quadriennale perpetuo "Cesare Zucchini"*, Cassa di Risparmio, Bologna.

263. **Italy: A special course on Training in Fisheries** was held in Rome when the II National Meeting of the Consortia of Vocational Schools for maritime skilled labor met in April last. The course was subdivided in three groups: technical-scientific, social-economic, juridical-legislative.

The first group dealt with: Lagoon and salt water fish (Prof. G. BRU-

NELLI); Migration of eels and sturgeons (Dr. T. CHIAPPI); Biology of tunny-fish (Prof. L. SANZO); Methods and Means of fishing (Prof. E. F. CANNAVIELLO); Motor fishing (Capt. M. FUSCO); Fishing and industrial impurities (Dr. C. MALDURA); Sponge fishing in Tripolitania (Prof. M. SELLA); Weather forecasts and navigation (Prof. F. EREDIA).

The second group held seven conferences: Emigration and Fishing in Eastern Mediterranean (Dr. E. NINNI); Management of large Fish Markets (Prof. G. PARDO); Organisation of fishermen's syndicates (Capt. G. RICCI); Sanitary assistance to fishermen (Dr. E. DELLA SETA); Invalid Fund in the Mercantile Navy (Dr. G. BRAMBILLA).

The third group delivered three lectures: Elements of Water Police Service (Major L POSSENTI); The maritime demesne and the fishing industry (Dr. C TREVES), The lower grades in the fishing and coasting trades (Dr. G. DE ANGELIS). A final lecture was delivered on: The co-operative-school movement and social-ethical education (Prof. D. LEVI MORENOS).

264. **Italy: Courses on Sericulture at the R. Experimental Silkworm Station in Padua** were inaugurated in April last, the following arguments being discussed: Present day problems (Prof Dr. L. PIGORINI, Director of the Station); Habits and particulars of arthropods and *Bombyx mori* (Prof Dr. G TEODORO, Vice-Director of the Station, and Dr. G. TONON), Embryology and morphology of the silkworm (Prof. Dr. G. TEODORO and Dr. G. TONON); Physiology and physiological chemistry of the silkworm (Prof. L. PIGORINI); Physical surroundings in relation to sericulture (Prof. Dr. L. DE MARCHI, Director of the Physical Geography Institute, University of Padua, and Prof. Dr G CRESTANI, Director of the Meteorological Observatory of Padua); Microbiology and immunity (Prof. Dr. O. CASAGRANDI, Director of the Hygiene Institute, Padua University); Silkworm Pathology (Prof. L. PIGORINI and Prof. G. TEODORO); Scientific Commercial Characteristics of cocoons and silks (Prof. Dr. G. COLOMBO), Director of the Experimental Silk Station, Milan); Scientific economics of the silkworm and silk industries (Prof. Dr. M. BOLDRINI, Prof. Dr. G COLOMBO and Dr. R. DI TOCCO); Application to practice (Dr R. DI TOCCO) At the end of the course, which lasts three months, a Diploma of Producer of Silkworm Seed is granted.

265. **Italy: Institute of Cereal Cultivation, Pisa.** – This new Institute has for its principal object the study and research of the types of wheat most suited to Tuscany and the practical experiments which will contribute to the improvement and increase of production. Prof. AVANZI of the Higher Agricultural Institute, Pisa, has carried on, for the past few years, a notable work of selection and grafting of wheats, arriving at some very satisfactory results. (*L'Italia Agricola*, Year 60, No. 12, Piacenza, 1925).

266. **Italian Somaliland: The Merca Institute for Sero-Vaccination.** — In 1911 the Italian Government instituted in Somaliland a Control Office and a Laboratory for the study of cattle diseases The work developed considerably and in 1915 an Institute for Sero-Vaccination with annexed zootechnic section was founded. This Institute, mainly undertakes the manufacture of rinderpest serum and has made steady progress in this, the output now being sufficient for the requirements of the Colony while its benefits

will before long be extended to the more distant and most nomadic tribes.

The Institute is well fitted for all bacteriological and parasitological research, with a pharmaceutical deposit, refrigerating plant, etc It effects vaccination as required at stated periods by means of a travelling Section, employing camel transport. The number of cattle vaccinated increased from 2000 to 76840 in 1924-25, and many tribes which had lost practically all their cattle have been able to build up their stock again in a few years. (*Bollettino d'informazioni economiche, Ministero delle Colonie*, XIII No. 4 Roma, 1925).

267. **Italy : Series of Lectures on Agricultural Archaeology in Rome.** – A course of lectures have been given by Ing GIULIO DEL PELO PARDI in which he stated the results of his enquiries into ancient Italian agriculture. The syllabus was as follows Introductory lecture .— Agriculture and Civilisation : -- Ancient Italian Agriculture and the Early Colonisations. — Early Land Improvements and the Cunicoli of Latium : hydraulics and irrigation as practised by the ancients (with lantern slides) : literature and treatises on agriculture .— the Latin Georgics – ancient agrarian terminology, the real meaning of the following Pomerium, Villa, Hortus, Viridarium, Lucus, Silva, Nemus and Saltus - Rustic rites and myths of the ancient Latin religion Old country festivals CATO *De Re Rustica* – illustrated and explained in the light of modern science

The course concluded in a most practical manner, by showing how from a sound knowledge of ancient Italian agriculture and a careful interpretation of the ancient Georgics, in particular CATO's *De Re Rustica*, very many valuable hints could be gained as to the application of the agricultural science of our own day.

The lectures were completed by excursions into the Campagna to see existing remains of ancient agricultural and drainage works Visits were also paid to the demonstration fields, which have been started by the lecturer at the Experimental Institute for Agriculture, Animal Husbandry, and milk production (*Istituto Sperimentale Agrario Zootecnico Lattifero*) at Monte Rotondo, which is utilised, administered and managed by the Ministry of National Economy).

268. **Italy : Institute of Cereal Cultivation in connection with the Bologna Co-operative Society.** — In Italy the improvement of wheat is being studied at the Rieti *Stazione di granicoltura*, and at the *Istituto di cerealicoltura* at Bologna. This latter is under the direction of Prof F TODARO and was opened in 1908, and the objects of its work are as follows · 1. to assist in the improvement of breed, with special reference to wheat, of the principal cereals cultivated in Italy , 2. to investigate the conditions of cultivation most suited to each type of wheat ; 3. to make each region produce, so far as possible, the seed wheat it requires ; 4. to submit the ordinary varieties of wheat to selection whenever it seems advisable ; 5 to enable students of the Higher School of Agriculture to complete their phytotechnical studies.

One of the most important departments of the Institute is that of research into the conditions most suited for each type of wheat, with a view to indicating the districts best adapted for the cultivation of a given type. The trading activities of the groups of producers are organised through an

office with headquarters at Piacenza (*Federazione Italiana dei Consorzi Agrari*). These consortia are established in all the regions of Italy by means of the local agricultural lectureships (*Cattedre locali di agricoltura*). In the Consortium of Bologna are included the Institute for Plant Breeding and the Co-operative Society for Seed Production. The varieties selected by the Institute and recognised to be of value are propagated by share-holder cultivators in the different agricultural centres or consortia. The crops are inspected by officials from the Institute who are present at the threshing and at the sealing of the sacks which go to the Society which pays the producer 1 to 2 liras more for the wheat than the maximum market price and later gives, if the seed proves satisfactory, an extra premium to producers.

Among the activities of Prof TODARO, the following may be mentioned : his investigation of the minor species of wheat, conducted by a process of selection from the cultivated fields of those plants which are distinguished by some special characteristic sowing and preservation of the finest stocks, seeds from which are issued to members, while the original improved type is always maintained pure. Great importance is attached to early maturity, as, if a late maturing wheat becomes scorched, the grain ripens badly and the cultivator gets no benefit from its yield capacity. Wheats with short straw are preferred as they are less easily laid MAYLIN describes the different activities of the Institute, the museum, the experimental fields, the farm houses and the different breeds of selected wheat He arrives at the conclusion that given a climate and geographical conditions similar to those obtaining in the Bologna and Carcassonne (Aude) regions, it would be advisable to try to introduce the varieties of selected wheat to be obtained at the Institute. (MAYLIN M [Station d'essais des semences de Paris]. L'Institut de céréaliculture de la Société co-opérative bolonaise, pour le production des semences de grande culture *Ann. de la science agronomique française et étrangère*, Vol 41, No 6 Paris, 1925).

269. **Oceania: Pan-Pacific Research Institute at Honolulu, Hawaii.** — The chief object of this Institute, founded by the Pan-Pacific Union, is the consideration of questions connected with the food resources of the countries of the Pacific Coasts Its work also includes the study of the demographic, ethnographic and health problems af these countries The Institute is administered by a council, consisting of representatives, elected from each Pacific country. There is also a Board of Governors composed (*a*) of the chairmen of each of the Permanent Committees formed from among the Institute members for the various branches of research ; (*b*) of the President of the Science Council of the Pan-Pacific Union , (*c*) of the general director and of the honorary president of the Institute ; (*d*) of members elected annually by the Board itself from among the scientists and technicians collaborating in the researches carried on at the Hawai headquarters.

The following studies and enquiries are carried out by the respective permanent committees : the Pacific coasts in general : the food resources of their waters ; land cultivation ; regional botany, ethnography and demography ; questions of health and sanitation ; the collection of useful plants in the Pan-Pacific Economic Botanic Garden ; animal husbandry ; meteorology ;

topography ; transport and distribution of food stuffs ; international legislation to facilitate agreements or treaties encouraging the development, utilisation and preservation of the natural resources (both animal and vegetable) of these regions ; agricultural entomology and phytopathology

Branches of the Institute will be formed in each of the Pacific Countries.

270. **Japan : The Sapporo Agricultural College.** — The Hokkaido Imperial University is the outgrowth of the Sapporo Agricultural College which was founded in 1876 The College itself may again be traced as far back as the spring of 1872. In that year a small preliminary school was started in Tokyo by the Colonial Department of the new Imperial Government with the object of training young men for the work of colonisation in Hokkaido. At the same time it was to serve as a stepping stone to a future higher institution of Agriculture and Engineering. In 1875 the school was removed to Sapporo, Capital of Hokkaido, and was called by the new name of the Sapporo School. Under recommendation of General Horace CAPRON, Commissioner and Adviser of the Colonial Department, the Japanese authorities succeeded in procuring the service of Dr William SMITH CLARK, President of the Massachusetts Agricultural College, to organise a new higher institution of Agriculture similar in plan and scope to the Agricultural Colleges of the U. S. A The name of the Sapporo Agricultural College was given to the new institution which was the earliest organ of agricultural higher education ever founded in Japan.

In 1907, the Tohoku Imperial University was opened with two Faculties, one being the College of Agriculture in Sapporo and the other the newly started College of Science in Sendai Thus the Sapporo Agricultural College became a component part of the Tohoku Imperial University, though only for a short time. In March 1918, the Hokkaido Imperial University was formed by an Imperial Ordinance with the Faculty of Agriculture separated from the Tohoku Imperial University and the newly founded Faculty of Medicine in Sapporo Preparation for the opening of the Faculty of Engineering is now actively going on.

In December 1922 the teaching staff of the Sapporo College as transformed into the Faculty of Agriculture consisted of 132 persons including lecturers, demonstrators, assistants, etc., giving instruction in 32 subjects. The instruction was divided into six sections agronomy, agricultural economics, agricultural biology, agricultural chemistry, forestry, and zootechnics and under each subject there is a syllabus of numerous theoretical and practical exercises. Two schools of an entirely practical character have been later added : the School of Practical Agriculture and the School of Practical Forestry, and there is also a School of Fishery

The Central University Library contained in March 1922, 34,160 Japanese and Chinese books, 38,085 European and American books and 3030 atlases, tables, pictures, etc.; the decimal system has been adopted for classification of the contents.

The Botanic Garden of 30 acres is located near the centre of Sapporo. It has about 6000 plants, foreign as well as indigenous There is also a museum which was erected 1883, this is open to the public and divided into

four sections: 1, Natural products; 2, Industry; 3, History, 4, Books, pictures and photographs It is celebrated for its valuable collections illustrating the natural history and anthropology of the Hokkaido.

The University demonstration farms are situated in different parts of the Island and cover in all 15,187 acres There is besides a garden of nine acres. There are four University forests in Hokkaido covering 183 163 acres, one in the island of Saghalin (48,793 acres), one in Korea (63,436 acres), and one in Formosa (16,782 acres).

The School of Fishery has a marine station and laboratory on the shore of a little harbour not far from Sapporo (The Development of the Hokkaido Imperial University, Sapporo, Japan, 1923).

271. **Russia : Installation of new Meteorological Stations in Mongolia.** — Prof W B SCHOSTAKOWITSCH, director of the Meteorological and Magnetic Observatory at Irkutsk, has organised, for the Government of Mongolia, a well equipped meteorological service In addition to the Urga Observatory, there are in existence at present seven stations at Uljassutai, Wangin, Chatyl, Dsain Schabi, Sangin, Ude and San Reisse These centres of observation were instituted with the support of the Central Geophysical Observatory at Leningrad (Dr. A PETERMANN'S, *Mitteilungen aus "Justus Perthes Geographischer Anstalt"*, Year 72, Parts 1-2, Gotha, 1926).

272. **Dutch Indies: Agricultural Research Institutes.** — Dr P J S. CRAMER, director of the Government Agricultural Experiment Station of Buitenzorg, Java, in a concise but full report made to the Pan-Pacific Scientific Council to be held this year in Japan, gives an account of the organisation of the research work, government as well as private, which is being carried on in the Dutch Indies Among the institutions directly subordinated to the Department of Agriculture are. the Buitenzorg Botanic Garden, directed by Dr W. M VAN LEEUWEN, which was founded in 1817, with a park which includes the summit of Mount Pangerango — 3000 m —, and with an alpine hut at a height of 2400 m for the study of the mountain flora; the General Agricultural Experiment Station (Buitenzorg), under the direction of Dr CRAMER himself, the Phytopathological Institute, directed by Dr C J J VAN HALL, and including two sections, a botanical and a zoological section, as well as the quarantine inspection service carried out at Tandjong Priok, Semarang, Soerabaja, Makassar and Medan (Belawan); the Division of Agricultural Economy, under the direction of Dr. CRAMER; the Government Experiment Station for the cultivation of quinine, situated in the desmesne plantations of Tjinjiroean, Pengalengan and the neighbourhood of Bandoeng, and directed by Dr. M. KERBOSCH, the Buitenzorg Agricultural College, under the direction of Dr. TH VALETON; the Forestry Research Institute, also at Buitenzorg, under the direction of Dr. R WIND, and including four sections timber technology; forest investigation from the botanical and technical standpoint; enquiry into the possibilities of re-establishment of forest species (apart from teak), enquiries as to the re-establishment of teak forests and forest protection; the Buitenzorg Laboratory of Veterinary Research, under the direction of the Veterinary Officer, Dr. C. BUBBERMAN, and including the sections of: general diagnosis, preparation of serums and vaccins, veterinary parasitology, and various kinds of research.

The Magnetic Meteorological Observatory of Batavia, directed by Dr. C. BREAK, is under the Naval Department. A number of flourishing private research institutions also exist in the Dutch Indies · an Experiment Station for the sugar plantations at Pasoroean, with a sub-division at Cheribon; the general Experiment Station of Rubber Planters of the East Coast of Sumatra (A. V. R. O. S), Kampong Baroe, Medan S O K.; the Buitenzorg Central Experiment Station for Rubber (Java), the Institute for Rubber Physiology, also at Buitenzorg; the United States of America Department for experiments on the rubber plantations, in Kisaran, Sumatra; the General Experiment Station for Tea and Rubber of Java region, with headquarters at Buitenzorg; the Scientific Service for the Rubber Plantations of an Amsterdam Company, in the neighbourhood of Medan; the Experiment Station for the rubber of Western Java, the Malang Experiment Station which chiefly deals with coffee and rubber, the Laboratory for the study of the insect *Stephanoderes hampei* Ferr., parasite of the coffee berries, and finally the two Tobacco Experiment Stations at Klaten and Deli (Dr. P J S. CRAMER. Institutes for Research Work in the Interest of Agriculture in the Netherlands Indies *Journal of Pan-Pacific Research*, Vol I, No. 2 Honolulu, 1925).

273 **Russia : "Dokoutchaev" Soil Science Institute at Leningrad.** — The Soil Science Section of the Permanent Commission for the Study of the natural resources of the U S S R, at the Academy of Science at Leningrad, has been re-named the Soil Science Institute, re-organised and transferred to a large building forming part of the geological museum of this Academy. The Soil Science Museum and special Library, bearing the name of the founder of Russian Soil Science, Prof V. V DOKOUTCHAEV, have also been transferred here The Director of the new Institute is F LOEWINSON LESSING, a member of the Academy (From a circular sent by the Secretariat of the Russian Institute of Soil Science)

274. **Czecho-Slovakia : The Union of Institutes for Agricultural Research.** — This Union includes all the public and private institutions in Czecho-Slovakia interested in the progress of the science and practice of agriculture Special Sections are formed for the study of particular problems · soil science, seed testing, investigations of fertilisers and on plant nutrition, phytopathology, questions of milk production, etc. Beginning from January of the current year the Union has published a bulletin (*Vestnik vyzkumných ústavu zemědělských*) with a supplement dealing with plant diseases. (Publishing Office. Prague II, Vaclavscké, No 47). (Communication sent to the International Institute of Agriculture).

275. **Czecho-Slovakia : Instruction in Cheesemaking.** — This instruction is given at special schools, at Frýdlant, founded in 1892, at Plzeň (dating from 1894) and at Kroměříž founded in 1902, all three being also attended by foreign students. An experimental station and a museum is attached to each school. There are also two other experimental institutes at Prague, one of which is attached to the Higher School of Agriculture while the other belongs to a limited company, which is however under the control of the Ministry of Agriculture.

Cheese manufacture in Czecho-Slovakia is also encouraged by the acti-

vity of bodies of the nature of syndicates with headquarters at Prague, Brno and at Bratislava respectively and are grouped into three co-operative federations. (Publication of the Ministry of Agriculture of the Republic of Czecho-Slovakia, Prague, 1 December 1925).

276. **Czecho-Slovakia : Report of a visit to the Agricultural Institutions.** — Dr. A. MARCELLO DEL MAINO has lately visited the most important of the agricultural institutions of Czecho-Slovakia, obtaining much and varied information especially as regards the cultivation of wheat and of the sugar beet. He is thus in a position to give an account of the work done by the Higher School of Agriculture and Forestry attached to the Grebova Polytechnic, by the Government Stations of Uhrineves (about 575 hectares including 432 of plough land), and of Clumec, directed by Prof. K. KAMENICKY, for the improvement of fruit plants, also of the Brno Experiment Station and the two private stations, namely the one at Clumec for selection and improvement of breeds of wheat, forage plants, and aromatic and medicinal plants, and the Semsice station (near Dobrovice), and finally of the Limited Company for the production of beetroot seed

The report drawn up by Dr MARCELLO DEL MAINO presents a summary of the notes which he was able to make on the scientific agricultural methods in use in the Czecho-Slovakian Republic, and conclusions of value are drawn by the author (Report forwarded by the author to the International Institute of Agriculture).

Agricultural and Scientific Associations and Institutions

277. **International Scientific Commissions at the International Institute of Agriculture.** — These Commissions are appointed by the Permanent Committee of the International Institute of Agriculture whenever it seems advisable to that Committee to call upon a body of competent persons to study and make decisions on questions coming within the province of the Institute Each Commission is called upon .

(*a*) to provide the Permanent Committee and the Bureaux of the Institute with advice on all questions submitted to it ; (*b*) to present their views of a technical and scientific nature on all questions falling within the competence of the Institute ; (*c*) to make recommendations to the Permanent Committee, requesting it to consider or cause to be included in the Agenda for the Commission any question of importance to the progress of the different sciences which have relation to agriculture ; (*d*) to establish through its members close relations between the Institute and men of science and scientific institutions, and vice-versa.

The work of each Commission is carried out as follows .— (*a*) by meetings in Rome, summoned on the motion of the Permanent Committee of the Institute ; (*b*) by consultation of all or some of the members, according to the nature of the question, by correspondance ; by the exchange of suggestion, information and advice, between each member and the Institute.

The various Commissions here referred to will together form the International Scientific Council of the International Institute of Agriculture. (Regulations for the *International Scientific Council of the International Institute of Agriculture*).

278. **China: Foundation of a Natural History Society at Pekin.** — This Society was formed in September 1925, on the initiative of Dr. A. W. GRABAN. Dr. G. D. WILDER was elected President, and after the organisation of the Society was completed, addressed the meeting on the subject of ' Some Common Birds of Pekin, illustrating the lecture by means of a number of mounted specimens of the Chinese birds and coloured plates of a number of closely related American birds. In addition were shown some copies of ancient Chinese paintings of birds. These were so accurate that in many instances the birds can now actually be identified from them. (*Science*, Vol. LXII, No. 1612, 1925).

279. **Hawaii : Honolulu Academy of Sciences.** — The Academy was founded some months ago with a membership of 80. The President is Dr. F. C. NEWCOMBE ; Vice-President, Dr. C. MONTAGUE COOKE.

280. **France : A Permanent Committee for Milk Testing.** — This Committee has been established by the *Société nationale d'encouragement à l'agriculture* and is formed by a combination of the Testing associations already in existence. The object of the Committee is to encourage the diffusion of the testing system, and to keep the associations thus combined informed of all that has been done in the matter and of all results obtained with a view to the establishment of further testing work. At the end of 1925, the Committee had extended its work to 13 breeds of cattle and 16 associations were formed for testing of the Norman breeds and 15 for the Flemish breed, whether exclusively, or at the same time as other breeds. (*La Vie Agricole et Rurale*, Year 14, vol. XXVII, No. 39, Paris, 1925).

281. **France : Chambers of Agriculture in the French Establishments in India.** By a Decree of January last, throughout these Establishments, the Governor has authorised the institution of Chambers of Agriculture for the protection of the agricultural interests of the Region. It is more particularly their duty to supply all information to the Government on the agricultural questions relating to their area, and to give their views as requested ; to transmit to the authorities all resolutions which they may pass on any question of agricultural interest ; and to carry out any departmental work that may be entrusted to them. These Chambers of Agriculture may be empowered to set up, to administer and to assist with funds within their respective areas, establishments, institutions and services of agricultural value and also any rural undertakings of a collective character. In the event of these undertakings having value both from the agricultural and commercial standpoint, grants may be made to them from the Chambers of Agriculture and the Chambers of Commerce, conjointly. (*Journal Officiel*, 26 January 1926).

282. **Great Britain : The Intelligence Department of the Ministry of Agriculture and Fisheries.** — A report on the work of the Intelligence Department of the Ministry for the three years 1921-24 has been published. It includes the work of agricultural instruction and experimental enquiries with relation to the production of milk, poultry keeping, horticulture and live stock improvement. This publication continues the similar report for the two years 1919-21 which contained a general account of the

policy adopted by the Ministry in agricultural research and education during the period immediately after the War.

The work of the Intelligence Department falls naturally into three main divisions: I. Research; 2. Advisory; 3. Education.

The Research Institutes and Stations of which there are 19 altogether are grouped according to the subject of their investigation and are when possible affiliated to a University.

Five of these Institutes deal with soil and cereal and forage crops, five with horticulture, four with animal pathology, three with animal husbandry, one with agricultural economics and one with agricultural engineering. The Institute of Agricultural Engineering is attached to the *School of Rural Economy at Oxford*. A new Institute of *Animal Pathology* has been founded at Cambridge. Advice on agricultural questions is usually given through the medium of the *County Agricultural Organiser* and his staff who are in direct contact with the farmer. This staff gives advice on matters of every day routine; they are so to speak the general practitioners for agricultural ills. When however they cannot prescribe the treatment themselves they can call in the specialist officers at the agricultural colleges. These Advisory Officers are placed at the centres known as Advisory Centres, generally a University or Agricultural College or a similar institution The area of administration of these bodies consists of a fixed number of counties which constitute a Provincial area.

The Advisory Officers in Chemistry, Entomology, Mycology, Agricultural Economics, Bacteriology and Veterinary Science thus form a link between the county staffs and the general body of research workers.

Agricultural instruction falls naturally into two main branches: *Higher Instruction* given at the Departments of Agriculture of the Universities, and at the Agricultural Colleges, and providing a two or three year course leading up to a degree or diploma, *Lower Instruction* provided by the local authorities and consisting of yearly courses or lectures on special subjects held at the Farm Institutes. Experimental work and demonstrations are also organised as well as shows and competitions.

These organisations are thus linked with each other by higher councils or committees such as the Research Council which includes all the Directors of the Research Institute, the Animal Diseases Research Committee, the Committee of Advisory Economists. These bodies carry out a work of co-ordination effected partly by the periodical meeting of the Advisory. Officers as well as in Provincial Conferences between the specialist Advisors of a given Advisory Centre and the County Organisers of the Counties belonging to a certain province and Advisory Centre. In addition a Conference of Organisers may also be held at a Research Institute.

The Ministry of Agriculture has the supreme control of all the organisations described.

The report is evidence of the great development of the organisation during the three years under consideration, a development due largely to the large grant made for the purpose. (Report on the Work of the Intelligence Department of the Ministry for the three years 1921-24. H. M. Stationery Office, 163 pp. Price 3/-).

283. **Great Britain: Report of the Fertilisers and Feeding Stuffs Advisory Committee.** — This Committee which was formed by the Ministry of Agriculture and Fisheries in December 1924 has drawn up a detailed report on the following questions into which enquiry has been made:

(*a*) designation of the fertilisers and feeding stuffs to which are applicable all the legislative measures proposed on the basis of the report of the Ministerial Committee on the Fertilisers and Feeding Stuffs Act of 1906; and designations of the fertilisers and feeding stuffs to which on the other hand are applicable only the civil provisions of the same Law;

(*b*) the definition of all the substances or classes of substances under consideration;

(*c*) note on the constituents which must be shown in the invoices and trading descriptions as present or not present in these substances;

(*d*) designation of those substances which are to be considered as either worthless or deleterious, as fertilisers of feeding stuffs.

The Committee could in addition fix the terms to be employed in the trade descriptions and invoices of the substances in question. (Report of the Fertilisers and Feeding Stuffs Advisory Committee. H. M. Stationery Office 36, PP. London. Price 9d).

284. **Great Britain: Veterinary Inspection of 1924.** — The Chief Veterinary Officer of the Ministry, Sir STEWART STOCKMAN has issued a report on the work carried out under the Diseases of Animals Acts. One of the principal headings of this report relates to Foot and Mouth Disease and another chapter to the Supply of Meat by means of the imports of store cattle mainly from Canada, the United States and South Africa. Mention is also made of the transit of stock from Ireland, the import of animals for exhibition and other exceptional purposes and the export of horses to the continent. The work carried on at the ports by the Port Veterinary Officers is described. The report is to be obtained from H. M Stationery Office, Adastral House, London, W. C. 2, price 1s 6d (*The Journal of the Ministry of Agriculture*, vol XXXII, No 9, London, 1925).

285. **Tripolitania: Agricultural and Meteorological Services.** By decrees of June 1925, the Government of this Colony has issued regulations for the: Agricultural Propaganda Office, Travelling Agricultural Professorships, the Experimental Station of Sidi Mesri and the Meteorological Services. The Agricultural Propaganda Office acts principally as advisor to the Colonial Government, controls plant diseases and stock-breeding, affords technical assistance to the agriculturists and stock-breeders of that region. The objects of the Experimental Station of Sidi Mesri are: *a*) the study of agricultural and economic conditions of the Colony in relation to its agricultural development; *b*) the study, through experiments and tests, of the crops best suited to these conditions; *c*) the study and application of the best methods of cultivation; *d*) the selection and improvement of races and varieties of plants and animals, in the strictly agricultural sense as well as in the zootechnical, suited to the climate and local resources; *e*) the carrying out of economic-agricultural experiments. The Meteorological Station is responsible for the daily reports of the meteorological and geophysical observations by the Tripoli Central Observatory, and for receiving

and collating in special publications, all meteorological data from the various Stations in Tripolitania, Cyrenaica and the Central Mediterranean Basin. It assists also the observers in the territory when such assistance is needed. (*Bollettino d'informazioni economiche, Ministero delle Colonie*, Year XIII, No. 4, Rome, 1925).

286. **Japan: The Japanese Association for the Advancement of Science** was founded in April 1925 and held its first meeting at Tokio. Dr. KOZAI, President of the *Tokyo Imperial University*, acted as Chairman. The second meeting will take place at Kyoto. (*Science*, Vol. LXIII, No. 1619, 1925).

Congresses and Conferences.

287. **Italy: International Conference on Emigration and Immigration. Rome, 15-31 May 1924.**

288 **XIIth International Congress of Agriculture, Warsaw, 21-24 June, 1925.** — Following on the information given in the last number of the Review regarding the resolutions passed at this Congress on Agricultural Instruction and Plant Production, and taking into consideration the fact that on the subject of phytopathological organisation and on epizootic diseases the conclusion which accompanied the separate reports (*v. Current Notices No. 3, 1925, of this Review*) have been accepted as final resolutions, hereunder follow the resolutions passed on Agricultural Experiments, Zootechnical Experiments and on Seed Testing.

Agricultural Experiments. — As numerous questions of a practical and theoretical character concerning varieties of improved plants, cannot be resolved except by collective experiments over long periods, the Congress invites the International Union of Growers of Selected Seed: *a*) to submit to the forthcoming Congress a draft of rules whereby it will be possible to compare and make use of the results of the experiments under discussion and those obtained in successive years in the various countries; *b*) to publish periodically in their own organ or in the *International Review of the Science and Practice of Agriculture* issued by the International Institute of Agriculture, Rome, all reports of general interest.

Given the importance of a rapid and economical solution of the numerous agricultural problems, the Congress invites the organs of the Agricultural Research Institutions of all countries to found an International Organisation having for its objects: *a*) the standardisation of methods of research; *b*) the supply to its members of all information regarding the research under study or in course of preparation; *c*) assignment to its members of specified research work; *d*) formation of a Drafting Committee which should publish all conclusions of general interest derived from the publications of different countries; *e*) the support of this International Organisation by the national Organisations already existing.

Lastly, for the study of soil science questions, the Congress is of the opinion that special international conferences should be held; and appoints, meanwhile, a Provisory Committee composed of Messrs. JELINEK (*president*), CASSADO DE LA FUENTE, DORPH-PETERSEN, JOURNÉE, KOSINSKY, ROY,

SISSESTI until such time as official members shall be appointed by the Governments or interested Institutions.

Zootechnical Experiments. — Given the necessity for zootechnical researches, the Congress has drawn the attention of Agriculturists to the advantages of: (1) the establishment of Zootechnical Research Institutes independent of Higher Agricultural or Veterinary Schools, having at their disposal land with stock of different breeds and varieties, and of an economic value; (2) the organisation of practical experiments, to be carried out under the direction of Zootechnical Research Institutes, on land belonging to the Agricultural and Veterinary Schools or Scientific Institutes, or even to private individuals who have the necessary staff and materials; (3) the consideration of the establishment of an International Institute of Zootechnical Research For the realisation of this programme, the Congress has, meanwhile, appointed a Provisional Committee composed of Messrs. CASSADO DE LA FUENTE, ADAMETZ, ARENANDE, COSTANTINESCO, DECHAMBRE, EVART, MOCZARSKI, V. WENDT, until such time as official members shall be appointed by the Governments or interested Institutions

Control of Seed Testing The Congress has made the following recommendations: (1) to give a permanent character to the technical control of the work executed by the Seed Testing Stations and to facilitate the training of the experts; (2) to publish every year a list of the Stations which have given results that may serve as a guide to international trade

The Congress has further drawn the attention of public bodies of the various countries interested in the seed export trade, to the necessity of giving their support to the International Seed Testing Association and of giving the highest consideration to its proposals for the regulation of technical and commercial seed testing

289 **Belgium: International Congress of Scientific Organisation of Labour. Brussels, 14-16 October 1925.** — On this Congress, held under the auspices of the Belgian Government, a considerable volume has already appeared comprising the reports presented at the Congress. The publication is divided in sections. General problems of organisation, Organisation of production, Determination of cost price, Sale organisation; Organisation of Offices, Application of the organisation to Administrative Public Services; Application of organisation to Agriculture. For further information on the Congress apply: *Secrétariat Général, Rue Montagne de l'Oratoire, 8, Bruxelles, Belgique* (Congrès International de l'Organisation Scientifique du Travail, pp. 317, large 4, ill., diag. Brussels, 1925).

290. **East Africa: International Agricultural Conference. Nairobi, Kenya,** end of January 1926. -- Invitations to this Conference which was arranged by the Government of Kenya were sent to the Governments of Tanganyika, Uganda, Sudan, Zanzibar, the Seychelles, Mauritius, Nyassaland, the Union of South Africa, Rhodesia, Mozambique, Belgian Congo, and Italian Somalia. The programme of work is in ten sections: Agricultural Production; Improvement of production; Experimental work in agriculture; Sale of produce; Classification of products; Agricultural Legislation; Stock breeding; Agricultural census and crop valuation; Agricultural instruction; Organisation of Agricultural Bureaus.

On the occasion of the Conference an agricultural show was held at Nakuro. It is hoped that further similar conferences will be held periodically, every three or five years, different colonies being chosen in turn for the meetings. So as to facilitate the work of preparation the head of the Agricultural Department or Bureau in the territory in which the meeting is to be held, will assume the office of president and his Government will provide for all the expenses of the visit of the various delegates.

291. **United States : IVth International Congress of Botanical Sciences. Ithaca, N. Y., 16-26 August 1926.** — This Congress will comprise Sections on : Agronomy (secretary : C. H. MYERS, Cornell University, Ithaca, N. Y.) ; Bacteriology (secretary : J. W. SHERMAN, Cornell University, Ithaca, N. Y.) ; Cytology (secretary : L. W. SHARP, Cornell University, Ithaca, N. Y.) ; Morphology, hystology and paleobotany: (secretary: D. S. JOHNSON, Johns Hopkins University, Baltimore) ; Ecology (secretary : H. L. SHANT, Bureau of Plant Industry, Washington, D. C.) ; Sylviculture (secretary: R. S. HOSMER, Cornell University, Ithaca, N. Y.) ; Genetics (secretary : C E. ALLEN, University of Wisconsin, Madison, Wis.) ; Horticulture (secretary: A. J. HEINICKE, Cornell University, Ithaca, N. Y.) ; Physiology (secretary : O. F. CURTIS, Cornell University, Ithaca, N. Y.) ; Pathology (secretary: DONALD REDDICK, Cornell University, Ithaca, N. Y.) ; Botanical pharmaceutics (secretary: H. W. YOUNGKEN, Massachusetts, College of Pharmacy, Boston) ; Taxonomy (secretary: K. M. WIEGAND, Cornell University, Ithaca, N. Y.) ; Mycology (secretary: H. M. FITZPATRICK, Cornell University, Ithaca, N. Y.).

Although the Congress does not provide for a special Section to deal with special questions such as "rules for nomenclature", the Organising Committee has taken necessary measures in order that each section may be able to discuss similar arguments of international interest.

All communications and informations in regard to each section should be addressed to the secretary ; those dealing with exhibitions and general to L. W. SHARP, Secretary Programme Committee of the International Congress of Plant Sciences, Stone Hall, Cornell University, N. Y. ; those regarding excursions, collective trips, transportation, etc., to H H. WHETZEL, (address as above), and those relating to the Congress in general to B. D. DUGGAR, Missouri, Botanical Gardens, St. Louis, Mo.

292. **United States : International Conference of Horticulture. New York City, 9-16 August 1926.** — It is being organised by the Horticultural Society of New York. The following subjects will be discussed : sterility of fruit in relation to seed production ; fruitculture and seed production under the horticultural and agricultural aspects ; botanical and general aspects of sterility and fertility.

293. **Pan-Pacific Scientific Congress. Tokyo, 27 October-9 November 1926.**

294. **First International Cold Congress. Rome, autumn 1927.**

295. **Pan-Pacific Medical Conferences.** — Dr. IGA MORI, delegate of the Pan-Pacific Union and executive secretary of the VI Meeting of the Far East Association of Tropical Medicine, held few months ago in Tokio, gave formal promise that the Association, on being invited to a Meeting to be held in India in 1927, would hold another meeting in 1929 in Honolulu,

Hawaii. Dr. G. B. COOPER, ex president of the Sanitary Office of the Hawaii Territory, and delegate of the Hawaii Government to the Tokio Conference, as well as special delegate of the Pan-Pacific Union, gave also assurance that after the India Conference 1927, the Union and the Association above mentioned would hold their meetings on Hawaiian territory.

296. **The IVth International Conference of Entomology, 1928** will probably be held in Honolulu, Hawaii. Preceding Conferences were held in Brussels (1909), Oxford (1912), Zurich (1925). That arranged for Vienna (1915) was not held. The Pan-Pacific Union has appointed a committee of entomologists, which will become permanent should the Conference be held in Honolulu.

297. **Proposal for a Conference to be held on Polynesian Races** has been made by Sir JOSEPH H. CARRUTHERS in the *Bulletin of the Pan-Pacific Union*, no. 72 (Honolulu, 1926).

298. **Spain: National Conference on Sericulture. Madrid, May 1926.** — Organised by the Council of National Economy, Ministry of Agriculture (*Fomento*) and Labour. Programme: (1) Cause of decadence of sericulture in Spain. Present situation. Necessity of rebuilding national silk industry. (2) General campaign for the progress of Spanish sericulture: *a*) distribution of knowledge on silkworm culture, *b*) installation of silkworm frames, *c*) planting of mulberry trees, *d*) utilisation of existing mulberry trees, *e*) rearing of the silkworm, *f*) installations for the suffocation of cocoons, *h*) national production of selected silkworm seeds, *i*) national production of chirurgical silk, *j*) advisability of furthering silk spinning in Spain. (3) Spanish legislation and national sericulture. Examination of the present legislation and improvement of seric activities. (4) Protection of the silk industry and revision of present legislative measures (5) Creation of a Higher Central Body to co-ordinate and control legislative measures on sericulture.

299. **United States: Meeting of the American Association for the Advancement of Science. Kansas City, 28 December 1925 to 2 January 1926.** — A special number of *Science* (vol. LXIII, No. 1622, 1926) contains the report of this meeting drawn by the Permanent Secretary of the American Association for the Advancement on Science. As regards the agricultural sciences, the American Society for Horticultural Science presented eighty three communications and the American Phytopathological Society presented sixty three, including nineteen on diseases of cereals, ten on the pests of packing fruit, eleven on vegetable pests, six on virus diseases, nine on disease resistance and eight on miscellaneous subjects. Joint sessions were held of the American Phyto-Pathological Society and the Potato Association of America, also with the American Association of Economic Entomology. At the session of seed testing which was held by the official seed analysts a large part of the discussions was devoted to the methods of making germination tests and the genetics section was entirely occupied with the contribution of genetics to practical plant and animal breeding.

300. **United States: Fifth Congress of the International Union for Control of Tuberculosis. Washington, 30 September - 2 October 1926.**

301. **France : Congress on Stock Feeding, Paris, end of October 1925.** — This Congress was organised by the *Société nationale d'encouragement à l'agriculture*. General questions relating to stock feeding were handled by A. LEROY, chief of the Animal husbandry work at the *Institut agronomique*. He gave a short review of the publications on the subject which appeared in France. A number of reports were read on the new theories of feeding, on forage feeds for milch cows and butchers' beasts and on the silage of green forage. Nine monographs were also submitted by different directors of the agricultural services on feeding of milch cows as carried out in their respective departments.

302. **France : Congress of the Ligue générale pour l'aménagement et l'utilisation des eaux. Grenoble-Lyons, 16-22 July, 1925.** — The previous Congress of this League had been held at Lille in 1924. Among the reports made to the 1925 Congress which are of interest in connection with the subjects treated in this Review may be mentioned the following : — Eng. SAUVANET : Water requirements for rural populations ; — Eng. PRÉAUD : Syndicates of Communes for the supply of drinking water ; — Eng. DE PAMPELONNE : Water requirements for irrigation in the sout heastern region , — Eng EXPERT : Utilisation of water for agricultural purposes by means of evenly distributed irrigation Other reports of an agricultural bearing were of a more or less local character. For information apply to the Headquarters of the League : 4, Carrefour de l'Odéon, Paris (6)

303. **France : French Congress on Birth Rate Problems. Clermont-Ferrand, 24-27 September, 1925.** - Five Sections : Legislation ; Economy and Vocational Policy ; Statistics and Propaganda ; Morals and Instruction ; Hygiene of the Dwelling House

304. **Great Britain : Congress on the Production of Vegetable Oils, London.** -- The usual annual Congress of the International Association of Seed Crushers took place in London in 1925 the Austrian and German delegates being present for the first time since the War. Italy was represented by Dr. BOLIS, Signor DI FAUSTO, Dr. MARANZANA, Dr. PALLAVICINO. As is well known the main object of these Congresses is to effect a gradual improvement, in accordance with the shippers, of the methods of International Commerce with oil seeds and oils. One of the characteristic features of this year's Congress was the tendency which was more and more evident to bring into consideration both the oil content, and the quality of the oil obtained from the various seeds as points to be submitted to arbitration. In this way it was resolved that an analysis of the content in oil in any arbitration relating to the quality of seeds must always be arranged for when requested by one of the arbitrators ; that enquiries should be made with a view to introducing into contracts for dry decorticated ground nuts a guarantee clause safeguarding the purchaser as to the maximum quantity of fatty acids : the question will be later carefully considered whether it is preferable for samples of the oil seeds to be preserved in milk or in glass.

305. **Italy : Congress on Agricultural Experiment, Rome, 19-20 March 1926.** — This Congress was held under the patronage of the Minister of National Economy, His Excellency BELLUZZO. Dr. G. Borghesani was

present in the capacity of Observer for the International Institute of Agriculture. Following communications were made: Prof. LUIGI SAVASTANO, Proposal for an official publication, " Reviews of Italian agricultural enquiries " (*Sunti degli studi agrari italiani*); Prof. NOVELLO NOVELLI, Problems of Rice cultivation; Prof. UGO BRIZI, Losses to agriculture produced by industrial establishments; Prof. GIROLAMO MOLON, The index of separation of the seeds in the table grape; Prof. GIOVANNI MARTELLI, Result of certain experiments in control of crop pests; Prof. FRANCESCO SCURTI, 1. Position of Fruit growing in Italy. 2. The problem of Fruit preservation; Prof. BARTOLO MAJMONE, 1. Co-ordination of the action of Agricultural Experiment Stations with that of the local agricultural lectureships in respect of the experiment and practical demonstrations. 2. Practical value of certain methods of stock feeding; Prof. GIOVANNI SANI, New ideas in manufacture of oils; Prof. ANTONIO MAROZZI, Agricultural experiment of the industrial and technical type; Prof. ANTONIO ZAPPI RECORDATI, Main problems of bee-keeping and the contribution of scientific experiments; Prof. CORRADO LUMIA, Some questions relating to Phosphatic fertilisers in connection with experiment; Prof. GIROLAMO AZZI, 1. Development on enquiries and research in the sphere of Agricultural Ecology. 2. Agricultural Ecology in relation to genetics as applied to agriculture Prof. GIOACCHINO DE ANGELIS D'OSSAT, Contribution to the study of agricultural land. Reports: Prof. VITTORIO PEGLION, Agricultural experiment and the measures of the Fascist Government; Prof. ANGELO MENOZZI, 1. Necessity for soil analysis. 2. Position of Research in regard to "stimulation" for plant development; Prof. NAZARENO STRAMPELLI, Reasons for and method of research into new varieties of wheat by means of hybridisation, adopted at the Royal Experiment Station for Wheat Growing at Rieti; Prof. FILIPPO SILVESTRI: 1. Modern methods of control of plant parasites. 2. Control of certain kinds of pests of the citrus fruits; Prof. OTTAVIO MUNERATI, Methods in experimental work; Prof. EMANUELE DE CILLIS, Report on the Experimental Institutes established for the " battaglia del grano " in Southern Italy and in the Islands; Prof. LIONELLO PETRI, Experimental work in plant pathology; Prof. GIACOMO ROSSI, 1. Need for collaboration for the scientific study of agricultural problems. 2. Preliminary notes on methods of bacteriological research in the examination of agricultural land; Prof. ALESSANDRO MARTELLI, On the direct use of ground phosphorites and leucites; Prof. GAETANO BRIGANTI, Problems of horticulture etc. in Southern Italy; Prof. GIUSEPPE TOMMASI, Activities and requirements of the agricultural stations.

306. **Italy: IInd Congress of the National Irrigation Federation. Bari, 14-16 April, 1926.** -- The Congress discussed questions on agricultural credit, irrigation and land transformation. Amongst the places of interest visited by the Members of the Congress were: the Experimental Irrigation Fields belonging to the " *Acquedotto Pugliese* " at Foggia. For information apply to " *Sede Centrale della Federazione Nazionale delle irrigazioni* ". Milano, 31, Via Monforte: Roma, 73. Piazza. SS. Apostoli.

307. **Italy: V National Congress of Labour Medicine. Genoa, 12-15 October 1926.**

308. **Italy : IInd National Congress of Pure and Applied Chemistry. Palermo, 23 May-2 June 1926.** — Coincides with the centenary celebrations of the birth of STANISLAO CANNIZZARO.

Exhibitions, Fairs, Competitions.

309. **Belgium : Centenary Exhibition, Brussels, 1930.**

310. **Belgium : International Exhibition. Brussels, 1928.**

311. **Italy : International Exhibition. Milan, 1928.**

312. **Poland: International Exhibition. Warsaw, 1928.**

313. **France : VIIth International Exhibition of rubber and other tropical products. Paris, 21 January-6 February 1927.** — Organised by the Committee of International Rubber Exhibitions, under the honorary Presidency of Lord COLWIN and of the ex director of the Imperial London Institute, Sir WYNDHEM DUNSTON, and the presidency of H. GREVILLE MONTGOMERY, will be held at the Grand Palais and will be the First International Exhibition of tropical and sub-tropical agriculture. Adherence has been received from : the Rubber Growers' Association ; Governments of Ceylon, of the Malay States, the Dutch Indies, the Gold Coast, Nigeria, Belgian Congo, Brazil, Columbia, etc. The Exhibition is under the auspices of the French Ministry of Colonies, Foreign Affairs, Commerce and Industry, and the Under-Secretary for technical instruction.

During the Exhibition, under the presidency of Prof. EM. PERROT Pharmaceutical Chair, Paris, and Sir WYNDHEM DUNSTAN, International Conferences on tropical agriculture will be held, following the lines traced at the preceding Exhibitions in London and Brussels. An International Congress for the scientific and technical study of the various branches of tropical agriculture is under project. For information apply to the *Administration of International Exhibitions*, 43, *Essex Street Strand, London, W. C. 2.*

314. **France : LIIIrd International Exhibition of Aviculture. Paris, 10-15 February 1926.** — Organised by the *Société Centrale d'Aviculture de France* at the Exhibition Park of the City of Paris (Gates of Versailles).

315. **Austria : International Fair. Vienna, 7-13 March 1926.**

316, **Italy: International Building Exhibition. Turin, May-June 1926.**

317. **Italy: International Competition in machinery for transplanting rice and other cereals. Vercelli, April-June 1926.** — This Competition has been set by the Royal Experiment Station of Rice culture of Vercelli, under the auspices of the Ministry of National Economy and of the Experimental Institute of Agricultural Mechanics. Preference was given not only to machines executing the operations of transplanting as much as possible by automatic means, but also to machines which could be used for the transplanting of other cereals, specially wheat. Experiments were to be of two kinds : preliminary (working of the machines when still on dry ground, etc., taking apart of the machines, resistance of the various parts and working resistance) on rice fields of the Vercelli province, on grounds of medium grade of dampness employing plants of the " Original Chinese "

variety or similar varieties, with normal development (40-50 days after sowing) and even on grounds of different degrees of dampness or with other variety of rice or with plants with different grades of dvelopment. To these were to follow laboratory experiments to control the functioning of the machines under the most varied conditions, and trials on other plots, of machines to be used also for the transplanting of other cereals

318. **Italy: International Competition of Viticultural Machinery, Barletta.** — This Competition is set by the *Cantina Sperimentale* of Barletta and deals with: A) Mechanical appliances, either by direct traction or funicular suitable to the execution of. (1) deep ground work for the planting of vineyards; (2) work of medium depth or superficial for ditches; B) special ploughs, harrows, and cultivators either by mechanical or animal traction, C) appliances for the spraying of insecticide and fungicide substances either by mechanical or animal traction For particulars: *Director of the Cantina Sperimentale, Barletta, Italy.*

319. **Italy: International Sample Fair, Padua, 5-20 June, 1926.**

320. **France: International and Colonial Sample Fair, Bordeaux, June, 1926.**

321. **United States: World Fair, Philadelphia, 14 June-1September 1926.**

322. **Germany: Agricultural Fair, Cologne, July 1926.**

323. **Italy: International Exhibition Fair, Fiume, 1-30 August 1926.**

324 **Danzig: Fourth International Exhibition, August 1926.**

325 **Italy: Fifth International Roadmaking Exhibition, Milan, September 1926.**

326 **Switzerland: Ninth International Agricultural Exhibition, Geneva, September 1926.**

327 **Germany: Dog Show, Berlin, 22-23 February 1926.** — The German Shepherds' Dog Union (*Deutscher Schaferhund-Verband*) organised this exhibition which was planned to include a number of breeds of ordinary dogs as well as breeds specialised for various kinds of uses, life-saving breeds, large watch-dogs, messenger dogs, etc A number of exhibits of various breeds were made by the *Berliner Hunde-Renn-Club.*

For information apply to. *Deutscher Schaferhund-Verband, Sekretariat: Berlin-Wilmersdorf, Zahringer Strasse, 26*

328. **Germany: Photographs illustrative of Scientific Stock Breeding shown at the XXIth Travelling Exhibition of the German Agricultural Society. Stuttgart, 18-25 June 1925.** — At this exhibition to which reference has already been made in an earlier number of this Review (October-December 1925), the *Deutsche Landwirtschafts-Gesellschaft* resumed the zootechnical photographic exhibits. Before the war the Prussian Ministry for Agriculture, State Lands and Forests offered as prizes for agricultural and stock-breeding exhibits from the different States of Germany the photographs and phototypes of this Exhibition. These are accurate reproductions showing the progress which is being made in Germany in the breeding of animals of value to agriculture. The reproductions also are well adapted for instructional purposes. To every photograph is at-

tached a note of the species of the animal, breed, ancestry, measurements, weight, etc. For information apply: *Deutsche LandwirtschaftsGesellschaft, Berlin S. W.* 11, *Dessauer Strasse* 14. Orders also taken.

329. **Germany: XVIth General Exhibition of Aviculture. Dresden, 15-17 January 1926.**

330. **Germany: Agricultural Week. Halle on Saale, 19-22 January 1926.**

331. **Germany: Bavarian Agricultural Week. Munich, 25-27 January 1926.**

332. **Germany: Saxon Agricultural Week. Dresden, 25-29 January 1926.**

333. **Germany: Exhibition of Poultry and Rabbit Breeding. Greifenberg, 14-16 February 1926.**

334. **Germany: Technical Exhibition of Lighting, Heating and Cold. Königsberg, 14-21 February 1926.**

335. **Germany: Great Tobacco Fair. Berlin, March 1926.**

336. **Germany: Colonial Fair. Berlin, 14-16 April 1926.**

337. **Germany: Fair and Exhibition of Hygiene, Berlin, late April.**

338. **Germany: Horticultural Exhibition. Dresden, May-September 1926.**

339. **Germany: Great Sanitary Exhibition. Düsseldorf, May-October 1926.**

340. **Germany: Slaughter Stock. Exhibition Berlin, 11-13 May 1926.**

341. **Germany: Agricultural Exhibition. Lubeck, 15-16 May 1926.**

342. **Spain: Vth National Competition of Animal Husbandry, Aviculture, Agricultural Machinery and material for rural instruction. Madrid, 14-23 May 1926.** — Organised by the General Association of Stock Breeders of Spain

343. **France: LIInd Avicultural Competition. Paris, 7-11 November 1926.** — Organised by the *Société Centrale d'Aviculture de France* at the *Jardin d'Acclimatation.*

344. **Algeria: Wheat Competition and Exhibition. Algiers, October 1925.** — Organised by the Chamber of Agriculture of Algiers, Oran and Costantine. For particulars: *M. le Commissaire Général de l'Exposition de blés Institut Agricole d'Algérie*

345. **Tunis: Exhibition of Hygiene. Tunis, 2-5 April 1926.** — Held on the occasion of a Medical Congress

346. **Ireland: Agricultural Exhibition. Dublin, Spring 1926.**

347. **Italy: National Chrysanthemum Show. Trent, November 1925.**

348. **Italy: Zootechnical Competition at the Milan Fair. April 1926.** — Show of milking and reproduction stock: 12-14 April; Livestock show (international competition of fattened livestock): 16-18 April; show of pigs, sheep and goats: 12-18 April; Dog show, poultry, pigeon and rabbit show: 20-22 April; Horse show, forming part of the International Competition organised by the "*Società Italiana del Cavallo Belga*", and the Shoeing Competition: 23-25 April. On 17-18 April Field trials were held for Conti-

nental Dogs, registered at the K. C. J. and L. I. R.; on 26-27 Military Horse Races were run.

349. **Italy: Sicilian plough Competition. Caltanissetta.** — Under the auspices of the Ministry of National Economy and the Permanent Wheat Committee, this Competition was set by the Caltanisetta Chamber of Commerce and Industry, together with the Provincial Commission for Wheat Propaganda and other Public Bodies of that region, for "a plough or machine answering to the peculiar condition of the soil, climate and traction means existing on most landed properties in Sicily". This competition (entries closed on 31 May) is being held on the occasion of the First Regional Wheatculture Show which will open in September 1926. There will be three prizes each for L. 35 000, L. 20.000, and L. 10 000 and small prizes for competitors presenting a system of harness which will utilise, in the best possible way, the efforts of the horses for the traction of the plough or the equivalent machine. For particulars *Executive Committee for the Competition c/o the Chamber of Commerce, Caltanissetta*

350. **Bessarabia: Exhibition and Sample Fair. Chisinau.** — The State agricultural and viticultural institutions exhibited a vast scientific material. The National School of Viticulture of Chisinau, the Administration of Crown properties, the Roumanian agricultural, horticultural, forestry, piscicultural institutes, etc., were well represented. The Union of Wheat Growers of Czeco Slovakia has exhibited a collection of selected wheats. Firms from Poland and Czeco-Slovakia contributed largely to make the products of their industries well known. France also had considerable exhibits.

351. **Japan: IInd Exhibition of Chemical Industries. Tokio, 19 March-17 May 1926.**

352. **Russia: Exhibition of Technical Innovations. Moscow, 15 February-15 April 1926.**

353. **Georgia: Agricultural Exhibition. Tiflis, 15 April-1 June 1926.**

354. **Switzerland: Exhibition and Slaughter stock Competition. Langenthal, 29-30 March 1926.**

Development of Agriculture in the different Countries

355. **Brazil: Cotton Growing in the State of Sergipe.** — The President of the State of Sergipe, with a decree dated 8th February 1923, founded the Cotton State Department, leaving the Experimental Cotton Station "*Miguel Calmon*" under the direction of Prof. TH. R. DAY, a well known North-american specialist. Thus were created the Experimental Stations of "José Bezerra" in Dores, "Simões Lopez" in Propriá, "Pereira Lima" in Estancia, "Candido Rodrigues" in São Paulo de Sergipe.

On the 20th August 1923 the above Department called the first Meeting of Cotton Growers to discuss the most important questions. From this Meeting the Department collected precious data for the regulation of the cotton industry, and the State Government issued the law of 21 September 1923. In the following year the first Cotton Fair was organised in Aracajù (25 Feb-

ruary). In 1924 all the work done by the Experiment Stations was damaged by heavy rains, which beside flooding the cultivations, paralysed the traffic and hindered the efforts of the Department. This notwithstanding, the results were satisfactory and the selectioned seeds obtained were above the necessities of the State of Sergipe. First quality cotton was exported to South Brazil. Seeds of the " Day's Pedigree " variety were supplied to the State Growers and to the Governments of Santa Catharina and Bahia. (*Mensagem apresentada á Assemblea legislativa em 7 de Setembro de 1925 pelo Dr.* MAURICIO CARDOSO, *Presidente do Estado de Sergipe*).

356. **Brazil : Cultivation of Lucern (Alfalfa) in the State of São Paulo.** — Lucern has always been largely cultivated in the country of Chavantes in the State of São Paulo In many regions of this State it is grown on all farms for grazing purposes and it proves to be an excellent feed producing fine live stock. (*Dr* ROGERIO DE CAMARGO, *A Cultura de Alfalfa en São Paulo. Ceres, Revista de Agricultura*, São Paulo, Setembro 1925).

357. **Brazil : Production of Tobacco.** - The State of Bahia produces 90 % of Brazilian tobacco. The crop for the season 1924-25 amounted to 34,650,000 kilogrammes, while a production of 48 millions and a half was expected. Brazil tobacco goes all over the world, except to the United States and to England. There are no large tobacco plantations, as cultivation by the modern systems would be very costly. Nor is the soil manured and if the tobacco is of good quality it is due to the climate The varieties imported from Sumatra and Cuba have not given any important results Harvest is begun in July or August and goes on for five or six months. Every 1000 plants produce 150 kilogrammes of leaves. The plants are attacked more by insects than by cryptogams ; among the insect pests are the larva of *Protoparce paphus* which eats the leaves The manufactured product is attacked by the coleopteron *Lasioderma serricorne* and by the washerwoman ant. (*O Agricultor.* Publication of the School of Agriculture of Lauras, Minas Geraes, Year IV, No 4, 1925).

358. **Brazil : The Rubber Problem.** — The immense forests of ' Hevea ' which are one of the principal natural resources of Brazil, especially in the Amazon province, and which would, constitute a very large source of income to the Confederation, cannot be properly worked from a number of circumstances, including want of transport facilities, absence of a protection policy, etc. all of which the Government is now anxious to remove The Department for Inspection and Encouragement of Agriculture is meanwhile issuing instructions to its inspectors in the Acre Territory, and in the States of the Amazon, the Pará, Maranhão, Piauhy, Bahia and Espirito Santo, with a view to their undertaking an intensive propaganda for the creation of new plantations, the distribution of seeds and the organisation of experiment and demonstration plots. It would appear however that the problem of Brazilian rubber lies in its home utilisation as a raw material, while waiting to secure its proper position on the world market. The national manufacture of rubber goods ought at the present time to absorb the production of the Amazon basin. (*La Gazette du Brésil*, No. 199. Paris, 1925).

359. **Brazil: Sylviculture.** — The writer DE ALMEIDA TORRES, of the Amazon province, in an article entitled " Breves notas para o Estudio Florestal do Brazil " (Publication of the Brazil Federal Ministry of Agriculture Industry and Commerce) treats the subject from the descriptive point of view. He prefaces the work by some historical notes on the study of Brazilian forests, beginning from the era of Portuguese colonisation, which he obtained from an interesting official document, dated 1809, giving full detail, which is preserved in the ' Museo Paulista ' of São Paulo.

The forest classification of the lands has not yet been properly studied in Brazil, although the Federal ' Instituto de Chimica e do Serviço Geologico Mineralogico do Ministerio da Agricoltura ' by its original research work makes provision for the study. The distribution of the Forests is as follows: A. Forests of the Equatorial Zone which reach their maximum development in the ' Hylaea ' of the Amazon region and cover some three million square kilometres. In the State of Pará alone there are reckoned, according to Dr. HUBER, to be 400 kinds of timber of which the most suitable for building are: " louros, canellas, acapú, pau roxo, sucupira, pau amarello, andiroba, massaranduba, tarumá, etc.

B. Forests of the Atlantic coast, from the Cape of S. Roque to the State of Rio Grande do Sul, where the best known timbers are the following. guarabú, canellas, cedros, perolas, pinheiros, jacarandás, vinhaticos, aloés, Gonçalo Alves, etc

C. The forests of the interior, where there is an abundant rainfall, are divided according to altitude into the forests of cerradão, caatanduvas and faxinaes, and the principal building timbers are perobas, jequitibás, aroeiras, cedros, massanduba, etc

D. The forests of the river banks, which as it were follow the variations in the course of the streams, and form the vegetation of the greater part of the central area of Brazil.

The building timbers found in these forests are ' aroeiras, pau de jangada, cedros angelins, louros, etc

3 The forests known as ' capões ', less extensive than the last type, mainly produce the timbers " cedros, cabreuvas, canellas, açeita cavallo, etc. ".

The nomenclature and the classification of the forest species of Brazil are to be found throughout the works of MARTIUS, EICHLER, FREIRE ALLEMÃO, ALEXANDER HUMBOLDT, HUBER, GLAZIOU, LOEFRGREN, DUCKE, BARBOSA RODRIGUES, etc. In the last few years the Belgian-Brazilian Biological Mission has also been publishing leading works on forest ecology, among them those of Prof. J. MASSARI of Brussels. At the present time there is an idea of founding biological stations for studies in acclimatisation, development and production of plants in relation to ecological factors.

The portion of the work of ALMEIDA DA TORRES which deals with forest economy is rich in statistical data.

Alagôas : 265,774 hectares of forests. The most remarkable of the products is the ' côco '. The school ' *Aprendizado Agricola* ' has been established in the town of Saturba at the expense of the Federal Government.

Amazonas : 6,273,554 hectares of forests. Rubber is the chief forest industry. The agricultural movement began in this State in 1916 with the foundation of the '*Club da Seringueira*'. A 'Horto florestal' has been formed recently.

Bahia : 1,761,353 hectares of forest. The Federal Government maintains in the State the "Aprendizado agricola da Joazeiro", and a similar training school called 'Francisco', and makes a grant towards the 'Escola agricola de Bahia' founded by the State Government. The 'Horto florestal' of the town of Joazeiro covers an area of 62 hectares and was instituted mainly for the purpose of establishing woods along the canals which the local government had had dug to the north-east of the State.

Ceará : 1,327,994 hectares of forest. The Federal Government makes grants towards the 'Escola de Agricultura Practica de Quixada' and the 'Escola Agronomica de Fortaleza', in both of which sylviculture can be studied. The 'Horto florestal' de Quiada, founded in 1911 in the locality of Cedro covers an area of 48 hectares, including 23 hectares of *Eucalyptus*, *Casuarina*, *Morus* and *Phoenix dactylifera*, and besides maintains an agricultural school.

Federal Area : 0,200 hectares of forest. The 'Secção Horto florestal do Jardim botanico' of Rio de Janeiro, established in December 1911, had distributed up to 1924 nearly 9,204,925 seedlings of Eucalyptus of different kinds and other forest species. There are also in this district a number of woods composed of native and exotic species.

Espirito Santo : 639,779 hectares of forest. In 1921 the State Government appropriated the estates of the 'Société Forestière' consisting of 2,100 square kilometres of primaeval forest with an immense number of species. The law of 23 December 1921 authorised the State Government to place contracts for the investigation of the forest resources of the State.

Goyaz : 5,286,336 hectares of forest. The Federal Government makes a grant to the 'Escola Pratica de Agricultura de Jatahy' which is to give general instruction in forestry.

Maranhão : 1,024,696 hectares of forest. In the region of the river Parnahyba the *Orbignya speciosa* Barb. Rodr. (Babassú) is very abundant and forms one of the chief products of the State. In the valley of the river Gurupy there are forests of *Copernicia cerifera* Mart., which produces the Carnauba wax. The Federal Government makes a grant to the 'Christino Cruz Aprendizado Agricola' of the town of S Luiz.

Matto Grosso : 3,032,964 hectares of forest. The *Hevea brasiliensis* Mull. Arg., which is rubber producing, grows abundantly in the forests of the boundary zone between the Amazon and the Pará provinces. The *Ilex paraguayensis* St. Hil. (the maté) grows in the South of the State.

Minas Geraes : 14,349,920 hectares of forest. Within the last few years the forest gardens of Bello Horizonte, Nova Baden, and Cataguazes have been made : the first of these distributed during the period 1921-24 nearly 1,458,154 seedlings of *Eucalyptus* and of other species. It may be remarked that more than two million plants of *Eucalyptus* have been planted on six farms alone.

Pará : 5,873,109 hectares of forest. The chief industry is the extrac-

tion of rubber from the *Hevea brasiliensis*. The forests of *Bertholletia excelsa* H. B. and K. are mainly found on the banks of the river Tocantina and near the Guianas.

Parahyba: 442,744 hectares of forest. The 'Horto florestal' of Parahyba is maintained by the State Governement.

Paraná: 2,448,133 hectares of forest. The law of April 1907 set up a State Forestry Code. The principal forest species are the *Ilex paraguayensis* St. Hil. and the most important timber is the *Araucaria brasiliensis* Lamb The 'Escola Agronomica do Estado' is an important institution for local work

Pernambuco: 721,978 hectares of forest The State possesses the following institutions: 'Escola de Agronomia' and the agricultural schools of Goiana and of the Benedictine Order which receive grants from the Federal Government: there is also the Course in agricultural science at the School of Engineering.

Piauhy: 6,333,637 hectares The principal species are *Copernicia cerifera* Mart, which yields the Carnauba wax, and the babassú (*Orbignya speciosa* R. Br) In the town of Therezina there is the 'Escola Practica de Agricultura' and in Corrente there is the 'Instituto Agricola Industrial' which is in receipt of grants from the Federal Government.

Rio de Janeiro. 1,069,872 hectares of forest The area of the ancient forests of the littoral is now much reduced. The Botanic Garden which is maintained by the Government is in Nichteroy.

Rio Grande do Norte: 440,481 hectares of forest. One of the principal products is the Carnauba wax. The 'Campo de Demonstração' which receives grants from the Federal Government is in Macahyba

Rio Grande do Sul. 440,213 hectares of forest The forestry service which is arranged by the 'Directoria de Terras' divides the forests of the Northern zone into nine sections placing them under the care of forest rangers The 'Escola de Agronomia de Pelotas' and the other school of the Municipio do Rio Grande are maintained by the local government authorities.

Santa Catharina 1,670,063 hectares of forest The main timber products are obtained from the *Ilex paraguayensis* The fellings are not regulated by law The 'Campos de Demonstração' of São Pedro de Alcantara and of Tubarão and the 'Instituto Polytechnico' are able to provide instruction in forestry.

São Paulo: 5,167,606 hectares of forest. There is a Serviço Florestal with a 'Horto e Reserva Florestals' situated in the Cantareira Pass, a well organised institution which during the period 1919-1922 distributed 5,738,132 seedling forest plants of different species. Valuable assistance has been given by private initiative to the State Government, the 'Hortos Florestaes' of the 'Companhia Paulista' situated in Jundiahy, Bôa Vista, Rio Claro and in other places having contributed to the peopling of the forest in many localities by distribution of some 20 million plants of *Eucalyptus* Instruction in sylviculture is given by the 'Escola Agricola Luiz Queiroz' and by the 'Escola Polytechnica do Estado'. In 1911 the forestry service was instituted and the law of December 1917 authorised the "Secretaria da Agri cultura" to improve the 'Horto Florestal' already mentioned using the funds of the 'Serviço Florestal' of the State.

Sergipe : 122,290 hectares of forest. The law of November 1913 established the Code of the Forest Service : and the regulations relating to this Code were made in April 1914.

Territorio do Acre : 2,785,333 hectares of forest. Chief products timber and rubber.

This important study made by DE ALMEIDA TORRES concludes with a list of all the short titles of the forestry legislative provisions, whether federal or State. A bibliographical chapter is added containing 91 headings.

360. **Chile : Agricultural Production.** — Dr. HANS ANDERSON, in a monograph published in a special part of the *Tropenpflanzer*, deals with the bases and the present day conditions of Chilean agriculture. Among the factors contributing to these conditions he passes in review that of the relief and hydrographical configuration of the country, the climate, the natural production, irrigation, ownership in land and fertilising. He examines separately and in detail the diffusion and the yield of the various crops of the region, cereals, leguminous or textile plants, rice, tobacco, cane sugar and sugar beet, the production of the various breeds of cattle and livestock, and finally in a few paragraphs he sums up his observations on the factors of a potential increase of yield from the agriculture of Chile and in particular : the more intensive cultivation of areas already cultivated ; increase of head of cattle on the pastures ; the irrigation of areas not yet utilised though suitable for agriculture, increase in the cultivable lands by the clearing of forest areas; improvement in transport conditions.

From the geographical point of view of agricultural production, Chile possesses vast regions which are suitable for cultivation and yet remain uncultivated on account of shortage of labour. In 1918, with an area of 750,572 square kilometres, the density of the population was reckoned to be only 5.3 to the square kilometre. The author notes that Chilean agricultural and livestock production has found its way and still finds it with profit on to the world markets, and while the export of nitrate has met with a competition which it is impossible to ignore in the increasing production of synthetic nitrogenous fertilisers, the State of Chile has before it a work of high importance in the settlement and colonisation of its arable land.

(H. ANDERSON, Die naturlichen Grundlagen und die gegenwärtigen Verhältnisse der Landwirtschaftlichen Produktion in Chile. *Beiheft zum "Tropenpflanzer"*, vol. XXII, No. 2, 145 pp., small 8 vo., 3 maps. Berlin, 1925).

361. **United States : Tobacco Growing in the Connecticut Valley.** — The Connecticut Agricultural College together with the Connecticut Valley Tobacco Growers Association has undertaken the agronomic study of this region in order to start and develop tobacco growing. (*Science*, No. LXII, No. 1617, 1925).

362. **Italy : Development of Sugar Beet Cultivation.** — In the Bulletin of Italian Sugar Industry (*Bollettino dell'Industria Saccarifera Italiana*, 1 January 1926), Dr. G. MORI points out the progress achieved by other nations in the production of sugar beet, and the measures and practice that should be adopted in Italy to improve the cultivation of this plant. He refers to the excellent and practical working programme elaborated by the

Agricultural Chair of Ravenna consisting in the diffusion of cultural technique, in the institution of practical demonstration fields to which national technical knowledge can be applied, and in setting Prize Competitions amongst the Beet growers.

363. **Tripolitania : Distribution of Electric Power for Agricultural Purposes.** — The "*Società elettrica coloniale di Tripoli*" which has built a large Central Power Station will be able to extend the distribution of electric power to the oasis of Tripoli, Gargaresc, Gurgi, Such el Giuma and Tagiura as well as to the nearest crownlands within the zone of concession. (*La Corporazione dell'Agricoltura*, year I, No. 2. Rome, 1925)

364. **Poland : Agriculture in Poznan.** – The following date are taken from a publication by the Agricultural Chamber of the Poznan Palatinate. on the occasion of the XIIth International Congress of Agriculture held at Warsaw in 1925. In the Poznan Palatinate — which covers an area of 26,603 km² — the ground suitable for cultivation represents a good 90 % of the total ara and contains 173.422 economic-agricultural units These units are spread over 2,366,936 ha., of which 49,5 % is represented by the medium and large rural property Complessively, the ground suitable to cultivation, the gardens and orchards amount to 65 7 % of the entire area of the Palatinate, meadows to 7 7 %, grazing grounds to 2 2 %; forests to 18.1 %. The area of large properties is sub-divided in Crown lands (294,400 ha), ecclesiastic properties (30,700 ha.), various public properties (4,700 ha.), private properties (1,083,800 ha.).

From the technical point of view, the development of agriculture has as index the use of chemical fertilisers which, annually, amounts to 882,000 q. of potash, 1,132,000 q of azote and to 3,701,000 of phosphates.

The crop figures per unit are very high as compared to other Polish regions and even to Germany. Amongst the cereals, first place is given to rye, followed, according to statistics, by wheat, barley, oats, and weeds. Each km² carries 210 fruit trees. The organisation for the production of selected seeds is completely up to date. In the economic life of Poland a prominent place is occupied by the agricultural industries of Poznan, principally the sugar industry, whose interests are represented by the "Union of Sugar Factories in Western Poland and by its organ" "*La Banque Sucrière*". Distilleries are organized in " The Union of Distilleries of Western Poland ".

Live stock production is well developed in Poznan. The type of horse bred resembles the East Russian The race is much improved by using government stallions, and efforts are bring made to breed a special military horse. As regards cattle, beside the black and white spotted type, there is, especially in South Poznan, a native breed, of uniform reddish coat, very strong, and most suitable for hard work. The black and white spotted type, which before the war was bred for slaughter is at present bred for milking, and consequently, a great number of breeders have now formed a Society for the Control of milk production. Pig breeding is well developed, two types being known, the native and the Yorkshire, whilst sheep breeding is not very diffused owing to the small profits there would derive. All live stock owners are organised in associations according to their respective branches.

The organisation of agricultural instruction is good. There is a faculty of agriculture and sylviculture at Poznan, a secondary agricultural school at Dojanovo, and numerous winter schools subsidised by the Agricultural Chamber, where classes are held from the beginning of November to the end of March. In summer the pupils attend a practical course. There are also schools of domestic economy, horticulture, dairy and cheese making, etc.

Agriculturers, organised either in public or private companies, are officially represented at the Agricultural Chamber, whose existence is guaranteed by the contribution payable by all agriculturists, who have the right to appoint the Board of Directors of the Agricultural Chamber.

Miscellaneous.

365. **Brazil : Mechanical Coffee picking machine.** — Dr ANTONIO DE BARROS UCHOA has invented at Riberão Preto, Brazil, a coffee picking machine, on the aspirating system, which will allow a considerable decrease in the number of hands employed on Coffee plantations This machine called "*Guanabara*" can be introduced between the rows without damaging the plants given its width measurements (m. 1,10-1,20) and small speed. It is horse drawn and worked by a Ford motor and requires three persons to handle it It picks and cleans 120 litres of coffee per minute using 36 litres of gazoline for every ten working hours. The machine in question has been recommended by several Brazilian experts amongst which are Dr MUCIO WHITAKER and Dr JORGE LOBATO MARCONDES MACHADO, of the *Sociedade Paulista de Agricultura* (*Gazetta da Bolsa*, Year IX, No. 7, Rio de Janeiro, 1926).

366 **Brazil: Resources and possibilities for the manufacture of mineral fertilisers in Brazil.** — Amongst the natural silica there are orthoclase and leucite, rich in potash, which can be utilised as they abound in Brazil in the Tinguá Mountains, Santa Cruz, Cabo Fris, Itatiaya, in the districts of Poços de Caldas, in the Atlantic islands of Fernando de Noronha and Trinidade 438 kg. of leucite pure (which corresponds to 490 kg of leucite at 90 % of potash) mixed with 504 kg. of nitric acid and with 448 kg. of chloride of potash, supplies 810 kg of saltpetre. Another source of material rich in potash is found in the manufacture of cement ; from one ton of this it is possible to obtain, as residual, 25 kg. of potash ; that is, an annual production, in a small factory, of 1000 tons of pure potash, or 3000 tons of potash fertiliser.

Phosphatic fertiliser is obtained from apatite, which is plentiful in the State of Minas Geraes near Cidade de Salinas, where the metamorphosis of the rocks of gneiss takes place. Apatite contains from 39 to 42 % of phosphoric acid. In other parts of Brazil kraurite and dufrenite are utilised, which contain 28 % of phosphoric acid. Another source of phosphoric acid is given by the monazitic sands which are formed by the erosive action of sea waves on the granite rocks of the Brazilian coasts of Praia di Massambaba, Cabo Frio, Macahè in the State of Rio de Janeiro, of Giry, Guarapary, Kova Almeida, Regencia, S. Matheus, in the State of Spirito Santo, and further of Prado, Cahy, Carahyba, in the State of Bahia.

The fusion of monazite with soda or with caustic potash, at a temperature of 500°-550° C produces phosphates of soda or potash, which can be transformed in calcium phosphate and used as fertiliser (Dr. FEDERICO W. FRIESE. Nossos recursos e possibilidades para o fabrico de adubos mineraes. *Revista da Sociedad Rural Brasileira*. São Paulo, 1925).

367. **Brazil: The use of eucalyptus for the production of printing Paper.** — Experiments made by the *American Forest Products Laboratory*, with eucalyptus timber of the State of São Paulo (Brazil) for the production of printing paper have given excellent results. Dr E. NAVARRO DE ANDRADE, who was present at the experiments made in Madison, is of the opinion that paper manufacture in Brazil will have a vast development, as with the timber in question it will be possible to place on the Brazilian market a product, at half the price of the imported product

The same species of eucalyptus used in these experiments grows in California, New Mexico, Arizona and Florida where the climate is suited to a rapid development of the tree and to the supply of cellulose pulp in less then ten years. (*Industrial and Engineering Chemistry*, Vol 4, No. 1, New York, 1925)

368 **Brazil: Climate in the State of Rio Grande do Sul.** - PAWELS, for his study on the argument, has taken all data from the Annual Bulletins of the Meteorological Service of the State of Rio Grande do Sul, as observations from other sources were not reliable A large number of Stations completed in 1922 a decennial period of observation There are 39 meteorological Stations in the State, making an average of one station for every 7,300 km², in the above bulletins they are subdivided in five regions Littoral, Central Depression, Country, Valley of Uruguay, Serra. (P G J PAWELS Subsidios para una climatologia do Rio Grande do Sul. *Egatea, Revista da Escola de Engenharia de Porto Alegre* Vol IX, Nos 3, 4, 5, 6, 1924; Vol. X; Nos 1, 2, 3, 4, 5, 1925)

369. **Spain: Artificial and natural silk.** – Artificial silk production in America is calculated at about 50 million pounds, in Italy at about 28 million lbs. and in Spain at about 300,000 lbs GONZALEZ MARIN's article shows the apprehensions regarding the future of the real silk industry to be without foundation The lower cost of artificial silk — to which a hardly suitable denomination has been given –, does not compensate for defects in appearance, in lasting qualities, etc, advantages to be found in the natural silk.

Contrary to general belief, the continuous development of the silk industry has not the effect of decreasing the price of raw cocoons, and no fears need be entertained as regards the future of this industry, given the ever increasing consumption of natural silk, as is clearly shown by the fact that no one year's production of silk can be kept in stock for successive years.

In Spain great efforts are being made to build up once again the former world renowned silk industry. Although Spanish production is insufficient for national requirements, silk is being exported in the raw state, which proves the importance given to the product itself. The author is of opinion that the creation of a national Spanish market would be advantageous, as obviating the necessity for relying on foreign markets.

The author concludes by enumerating the advantages of sericulture. The Spanish Government is taking the necessary steps for the diffusion of technical knowledge of this industry. (GONZÁLEZ MARÍN F. El extracto de celulosa y la seda natural. *El Progreso Agricola y Pecuario,* Year XXXI, No. 1401. Madrid, 1925).

370. **American Bibliography of the Natural Sciences.** — Some years ago the *American Library Association* undertook to publish a list of the hundred best works on Natural Sciences and to ensure accuracy invited the Academy of Sciences of Washington to co-operate and a special Revising Committee was appointed. Some few months ago a second edition of this list was published containing a short summary of each volume. Paragraphs deal with each group so as to give the reader a clear idea of science as a whole and its branches. The hundred works are grouped under the following titles: Works of general character; sciences of man; sciences of life, soil science, sciences of the skies, sciences of things and phenomenons; sciences of forms and relations; history of science. (*Revue générale des Sciences pures et appliquées*, Year 36, No 22 Paris, 1925)

371. **Estimation of productive qualities of ponds.** Mr. DE BROUIN DE BOUVILLE, Chief Inspector of Waters and Forests in France and French Delegate at the XIIth International Congress of Agriculture held at Warsaw, sums up his critical study on the estimation of the productive qualities of ponds, in the following conclusions, which were adopted by the Congress.

In the various countries where carpiculture is practised, uniform rules should be adopted for the determination of the biological, chemical and thermic state of the ponds, in order to define their productive qualities or possibilities, on which is based their scientific yield

Agreed methods should be used for obtaining comparable results regarding the estimation of the available fish feeding material by the introduction of planeton (*synthetic index*) and organic substances (*chemical index*), and for reckoning the period of utilisation of the material or in other words of the period of development of the carp, the physiological activity of which depends entirely on the temperature (*thermic index*) (*Revue générale des Sciences pures et appliquées*, Year 36, No 20 Paris, 1925

372. **France: Centenary of Chevreul's Discoveries on Fats.** — On the occasion of the Fifth Congress of Industrial Chemistry, held in Paris last October the *Société de Chimie industrielle* with the collaboration of the *Muséum d'Histoire naturelle* and of the *Société chimique de France*, commemorated this centenary in the same theatre in which CHEVREUL accomplished the greater part of his work. Among the speeches delivered on that occasion, that of Prof L MANGIN, director of the Museum, Member of the Institute and President of the Confederation of Scientific Societies in France, was reported *verbatim* in the *Revue générale des Sciences pures et appliquées*, Year 36, No. 22, 1925

373. **Animal Traction through the Centuries.** — The commandant LEFEBVRE DES NOETTES has published through the firm of Berger Levrault a detailed and accurate study of "La Force motrice animale à travers les âges". Using archaeological records, he gives a vivid account of the methods of traction, harnessing and shoeing practised in Assyria, Chal-

dea, Egypt, China, Greece, Rome, Arabia, etc. He carries the subject on to the Middle Ages and finally to our own times.

P. DE CHOIN. Stallion Stations (*haras*) Officer, who reviews this publication in No. 31, 1925 of *La vie agricole et rurale* refers also to information on the same subject, given by RINGELMANN, professor at the *Institut agronomique* in his "Essai sur l'histoire du Génie rural ".

374. **United States : " Vanderbildt University " and the Lyon geological collection.** — The geological section of the above University has acquired this private collection, begun in the time of SYDNEY S. LYON and then continued by his son VICTOR W. LYON. It consists of some thousands of fossils, principally from the classical palaeozoic district of Kentucky and of Indiana, also samples of minerals, some hundred pamphlets and about three of four thousand works on geology and palaeontology, and is probably one of the few remaining private collections of the last generation. (*Science*, Vol. LXII, No. 1617, 1926).

375. **United States : Elements of Systematic Pomology.** - Mr. B D DRAIN who teaches in the Massachussets College of Agriculture, has published a textbook on systematic pomology which should prove equally useful to students and experimentalists as to fruit-growers who already possess an adequate scientific preparation One chapter deals with fruit culture exhibitions The book contains numerous illustrations and a copious index (DRAIN B D. Essentials of Systematic Pomology, pp 284, large 16 mo, 106 illustr New York and London, 1925)

376 **Great Britain : A Catalogue of British Scientific and Technical Books.** - This is a volume issued under the auspices of the British Science Guild, the President of which is Sir RICHARD GREGORY The responsibility for the compilation of this catalogue rests principally with Miss D SHAW, Secretary of the Cataloguing Committee, but a certain number of competent compilers have collaborated with her for some of the special branches In a preface to the volume Sir RICHARD GREGORY states that the intention was to include in the publication all Scientific and Technical books issued by British publishers, excepting only those of a very elementary nature and those sold at less than two shillings Every book issued up till the end of 1924 is included here (A Catalogue of British Scientific and Technical Books. (New edition revised and enlarged. 489 pp in small 8° London, 1925. Price 12s 6d).

377. **Great Britain : A collection of the most important varieties of Wheat in existence.** - Prof JOHN PERCIVAL, M A, Sc. D., of the University Section of Agricultural Botany, Reading, England, has prepared a collection, containing as many as 1300 specimens of wheat, mounted on small pieces of paste board 36 cm. 28 cm. and contained in 13 boxes. This collection, on the model of the one at the Reading Experiment Farm, includes specimens from all over the world, and illustrates the great number of variations in this cereal. The collection, which is provided with an index, may be purchased from Prof. J. PERCIVAL for L.g 100 (From a communication sent to the International Institute of Agriculture)

378. **Australia and New Zealand : Agricultural Machines and Implements.** — The Department of Commerce of Washington, U. S A., has

published a monograph on this subject compiled by I. HOMS. The following subjects are dealt with: Topography, climate, soil, population, agricultural labour, statistics regarding the importation of agricultural machines and implements and the provision of agricultural utensils made in Australia and New Zealand. The general conditions of trade in agricultural implements are indicated and much useful information is given on principles of cultivation and on methods of production. (I HOMS. Agricultural Implements and Machinery in Australia and New Zealand Government Printing Office, 195 pp. 28. II Washington, D. C., Price 25 cents).

379. **Italy: The flower industry.** — In a concise monograph Eng. STACCHINI gives us his observations on the state of the flower industry. He examines successively its origin in Liguria, which is the most important centre of Italian production (noting that it began some 50 years ago), the reclamation of unproductive land, the conditions created by the war; the peculiar characteristics of the Ligurian flower industry, the extended cultivation and general care of the flowers. In the second part of his monograph the author studies carefully his economic data; the cost of production, the sale price; the characteristics of the markets, agricultural credit and available capital. He adds also some commercial statistics, calculating that 30,018,000 kilograms were exported between 1907 and 1910 at 3 lire the kilogram representing a value of over 90 million lire After the war (between 1921-1922) the author calculates that 4,378,561 kilograms of cut flowers were exported from the neighbourhood of Sanremo alone, between 1922-23 911,413 kilograms from this district and 7,152,091 from the whole of the Riviera Ponente, between 1923-24 5 230,583 kilograms represented the entire exportation of Liguria, as many as 4,804,537 coming from the district of Sanremo.

The author proposes, with a view to encouraging this important industry, that the flower-growers should be represented on the commissions dealing with international customs regulations that freight trains should be reorganised and co-ordinated, with provision of refrigerating cars to prevent deterioration of the produce. (STACCHINI P. Sull'industria floreale. Thesis submitted to the Technical Commission for the improvement of Agriculture).

380. **Kingdom of the Serbs, Croats and Slovenes: Plans for the promotion of agriculture and for a general supply of electricity throughout the country.** — By provisions contained in a law dated June 17, 1925, dealing with agricultural and co-operative credit, loans of long expiration are made by the Bureau of Agrarian Credit (an autonomic administration established at Belgrade) to the co-operative societies of agriculture. The object of these loans is to promote the building of grain-elevators, dairies, drying appliances, manufacturing works for agricultural machinery and artificial manure factories and also the installation of other plants to meet rural requirements: further they are to encourage the production and testing of seeds, and the preservation of fruit and vegetables. It is also intended to establish a central electrical plant and to supply power to the rural districts. These loans may also be extended to hydraulic societies which undertake protection against inundations drainage and the canalisation of water courses. (*Službene Novine*, No. 133, 1925).

Journals and Reviews.

381. **The Kühn Archiv.** — After an interruption of six years this well known review has just published Vols. 9 and 10. In consequence of the reorganisation of the Agricultural Institute of Halle on Saale, it now appears in three parts, each dealing with three principal subjects: agriculture, animal husbandry and agricultural industry, directed respectively by VON FROHLICH, STEINBRUCH and ROMER. The two volumes contain also the commemoration of the centenary of JULIUS KÜHN

382. **The "Tropenpflanzer"** which is the organ of the Agricultural Colonial Committee (*Kolonial-Wirtschaftliches Komitee*), has, with the beginning of the year, added a sub-title: "*Zeitschrift fur das Gesamtgebiet der Landwirtschaft warmer Lander*", to specify that the review not only deals with tropical agriculture questions, but with all general agronomical and zootechnical questions in hot countries. The review is published more frequently and is often accompanied by a supplement

383 **"Die Landgemeinde".** It is a new Austrian review started on 1 January 1925 and treats in an elementary form all problems regarding legislation, technique, agriculture and animal husbandry of interest to country and mountain Administrations This programme is embodyied in the subtitle of the Review. (*Organ fur Landgemeindeverwaltung und Landgemeindewohlfahrt Oesterreichs*) The Review is published once a month and is edited at Graz (*Heimatverlag, Salzamtsgasse*, No. 7) and the price is 8 shillings yearly.

384 **The "Fortschritte der Landwirtschaft"** (*Progress in Agriculture*) is a new fortnightly review edited in Vienna and Berlin by J SPRINGER (*Wien I, Schottengasse* 4) Its collaborators are the Chairs of the Higher Agricultural School of Vienna (*Hochschule fur Bodenkultur*) and the Austrian Institutes of Agricultural Experiments. The Directors are Prof Dr HERMANN KASERER and Dr. RUDOLF MIKLAUZ. Price: 6 Mks quarterly

385 Under the title **"Korrespondenz für Messe- und Ausstellungswesen"** a quarterly Bulletin of Exhibitions and Fairs is being published in Berlin Editor: HARRY FRIEDLAENDER, *Berlin W* 50, *Bambergerstrasse* 7. Price. 5 Mks quarterly in Germany and 6 Mks abroad

386. **The "Wiener Landwirtschaftliche Zeitung"** (*The Viennese Agricultural Gazette*) reached its 75th year on the 31 December 1925 and on the 9th of the same month the Printing House "CARL GEROLD'S SOHN", where the Gazette is printed, its 150th year.

387. **The "Tharandter Forstliches Jahrbuch"** is now published monthly; the yearly issue will amount to 384 printed pages instead of 288. Prof. Dr. BUSSE has been appointed Editor, in place of Prof. Dr. H VATER, who has retired and given up the editorship of the Review.

388. **"Das Grünland"**, organ of the Association for the promotion of the cultivation of marsh lands in Germany (*Verein zur Forderung der Moorkultur im Deutschen Reiche*) has published a special number, edited by the Union of the German Rural Associations (*Verein Deutscher Landeskulturgenossenschaften*). This Union, founded in February 1925, has as its scope the co-ordination of all activities directed to soil cultivation and its

prominent members are public or private companies interested in soil improvements.

This special number includes, amongst others, an elaborate article by Dr. BAUER, president of the Provisional Working Committee of the Union, on questions of modern agricultural improvements especially on landed properties of the German State. (*Sonderheft für Landskultur. Das Grünland,* November 1925).

389. **" Anzeiger für Schädlingskunde zugleich Nachrichtenblatt der Deutschen Gesellschaft für angewandte Entomologie ".** — Prof. DR. K. ESCHERISCH of Munich and Prof. Dr. F STELLWAAG of Neustadt a. d. Haardt publish monthly a " Bulletin on noxious insects " which includes the " Bulletin of the German Society of applied Entomology ".

390. **" Mikrochemie ".** — An International Committee of public collaboration publishes at Vienna "*Mikrochemie*", a review dealing entirely with microphysics and microchemistry.

391. **The " Zeitschrift für wissenschaftliche Biologie "** (*Review of Scientific Biology*) includes Section *C* of compared physiology (*Zeitschrift fur vergleichende Physiologie*) and Section *E* of scientific botany (*Archiv für wissenschaftliche Botanik*).

392. **" Die Volksernährung ".** — A new review published at Berlin dealing with scientific, economic, practical and technical questions inherent to the various problems of individual alimentation and that of demographic agglomerations Chief Editor Dr. MAXIMILIAN WINCKEL (Berlin-Schöneberg. Meraner Strasse I) It is published the 5 and 20 of every month Price: Mks 2 50 quarterly in Germany and 4 Mks abroad It is edited by the Berlin Firm ROTHGIESSER und DIESING A G.

393. **New American Journals.** — *The Pacific Coast Pacific Society,* in collaboration with the California Academy of Science, publishes a quarterly review called "*The Pan-Pacific Entomologist*"

The International Museum of Saint Barbara in California issues a half yearly bulletin entitled: "*The comparative Oologist and Journal of the International Museum of Comparative Oology*".

394. **Industrial and Trade Review for Asia.** — It is a new Review with the object of promoting Asiatic industrial development and commercial relations between Asia and other regions It is published fortnightly in Berlin, Charlottenburg. (104 Reichstrasse), Germany. Price: 12/- per annum and 7/- for six months

395. **Economic Geography.** — A new quarterly Review published in Massachusetts (U. S.) at the initiative of the Clark University. It is richly illustrated and contains many articles closely connected with agricultural economy The most important are. W. B. GREELEY. Geography in relation with timber supply; O. E. BAKER: Geography and grain production; CLARENCE J JONES: Canadian Grain Trade; G. R. STEWART: Rural police service on public properties; OLOF JONASSON: Study on demographic and rural maps; ELLS. HUNTINGTON: The distribution of domestic animals; C. C. COLBY; Apple industry in the Annapolis-Cornwallis Valley; O. JONASSON: Agricultural Regions of Europe; E. C. ANDERSON: Sugar-Beet industry

in Nebraska ; W. H. VOSKUIL : Utilisation of phosphatic resources in North America.

Price : 4 dollars per annum. Editorial Office : *Clark University, Worcester, Massachussets, U. S. A.*

396. **The "Revue Internationale des Tabacs"** is the title of a new monthly review edited in Paris (97, Rue Saint Lazare, Paris, IX^e) in which articles are published in the author's original language. It co-ordinates works sent in by any country, dealing with any question which have direct or indirect relation to tobacco. Detailed monographs will be printed on the tobaccos of Dutch Indies, Cuba, San Domingo, Kentucky, Virginia, Philippine Islands, Brazil, Paraguay, Columbia, Mexico, Tunis, Cameroon, Indochina, Madagascar, etc. The review contains sections on agriculture, industry, economics, legislation and will publish literary and medical articles on the physiological action of tobacco. Articles on historical archaeological and artistic research of this drug will be accepted.

397. **Veterinary Bulletin for Indochina.** — The *Bulletin Vétérinaire de l'Indochine* has started its quarterly publications and contains principally original articles, as well as reports, official informations, recensions, etc

398 **The "Journal of the Pan-Pacific Research Institution".** — Its first number came out on 1 January of the present year and will form a periodical records of investigations on the food resource problems (production, distribution, conservation and consumption) of the Pacific Coasts dealing at the same time with the sanitary, demographic and ethnographic questions relating to the population of these regions It will become also the organ of this large Institution created for the scientific and practical research work of the Pacific islands The Central Editing office is at Honolulu, directed by Prof F G KRAUSS of the Hawaii University. Correspondents : C L ALSBERG, University of Stanford , C F. BAKER, Philippine University , P. J S. CRAMER, of the General Agricultural Experiment Station of Java , C ISHIKAWA, Prof. at the Imperial University of Tokio ; Sir J BARRETT, K. B. E , of Melbourne (Australia) ; E D MERRILL, of the California University ; G M THOMSON, M P , of Wellington (New Zealand) , S. T WEN, of Shanghai ; C P. SIDERIS, of the Hawaii University and R. H. van ZWALUWENBURG, of the Experiment Station H S P A.

399. **The "Rivista di Malariologia"** is a continuation, on more independent lines, of the *Bollettino Malariologico* which used to form part of the well known periodical *Annali d'Igiene* edited by Prof. G SANARELLI

The new publication will however appear bi-monthly and will contain original articles with summaries in English and French, reports, etc , and a section for copious notes arranged on a systematic plan The first number of 112 pages with four tables and many illustrations contains 7 original articles contributed by experts in problems of malariology

Editorial and Managing office : Via Spallanzani 4, Rome (27). Editor in Chief, Dr. L. VERNEY. Subscription in Italy L 25. Abroad L. 50.

400. **"L'Italia Agricola"** has published a special illustrated numb . on agricultural conditions in Tuscany. The various problems and the different agricultural aspects of this region are treated in each chapter as follows : Pedology, by MARTELLI ; Land reclamation in the Maremme, by

GINANNESCHI, in the Val di Chiana, by PELLEGRINI; viticulture, by TOPI; enology by OLIVA; olivegrowing, fruticulture, and silviculture respectively by BONUCCELLI, RACAH and MERENDI. A special chapter by FREGOLA deals with the Tuscan "*Gentil Rosso*" breed; with the special cattle breeds "*Chianina*" and "*Maremmana*" and with the pig breed "*Cinta*" all by DONDI. Agricultural economic conditions are described by GARAVINI and agricultural instruction and experiments by FERRARI. All these articles are preceded by a summary on agriculture in Tuscany by BELLUCCI. (*L'Italia Agricola*, Year 62, No. 12, Piacenza, 1925).

401. **Journal of the Department ot Agriculture, Kyusku Imperial University,** is the title of a new bulletin issued by the Agricultural Section of the Japanese University in Fukuoka. It is published at irregular periods and contains signed articles in English and German.

Personal.

402. At the *Académie des Sciences* in Paris, M. BOUVIER commemorated TISSERAND, the oldest member of the Academy and ex Director General of Agriculture, who died last November in his 95th year. Appointed soon after 1870 Inspector general for agriculture, he induced the Government to establish the Practical Schools of Agriculture, which stand between the Farm-schools and the national schools already existing. He reconstituted in Paris the "Institut agronomique" which he directed until 1879. While General Director of agricultural services, TISSERAND did much to bring about the now existing far reaching organisation, especially as regards instruction and experimental work. Amongst his publications, the most note-worthy are those on plant life and cultivation on high mountains, and on the treatment of milk at low temperature. He was one of the first to interest himself in the question of practical experiments of anti-anthrax vaccination.

403. C. C. CALDER curator of the Herbarium in the Royal Botanic Garden of Calcutta has been appointed Superintendent of the Garden and of the cultivation of china in Bengal, and Director of the Botanic Services in India.

404. The death is announced of C. N. CATLIN, Professor of agricultural chemistry at the Arizona University and author of various works on soil chemistry.

405. J. G. COATES, M. P., Prime Minister of New Zealand, has accepted the honorary presidency of the *Pan-Pacific Union*.

406. The death of Sir FRANCIS DARWIN (1848-1925) in Cambridge, third son of CHARLES DARWIN, the great naturalist, ends a long series of fruitful work. He was an assiduous help to his father and in 1880 he published "*Physiology of Plants*". This book was followed by others dealing particularly with the localisation of the sensitive organs and the mechanism of transpiration. Sir FRANCIS DARWIN was instructor of plant physiology at Cambridge, transferring to this School his father's scientific library. His well known book "*Life and Letters of Charles Darwin*" (1887), completed later by "*More Letters of Charles Darwin*" (1903), has been judged as the best biography

ever written. He was a member of the Royal Society and of other important Scientific Associations and received degrees *ad honorem* from many British and European Universities. In 1912 he was awarded the Darwin Medal.

407 Eastern India has lost one of its most zealous sylviculturists by the death of JAMES SYKES GAMBLE, F R S., F. L S (1847-1925) From 1890 to 1899 he was Director of the Imperial Forest School of Dehra Dun publishing, during that period, several works on forestry. His "*Manual of Indian Timbers*", published in 1881, was reprinted in 1902 and 1922 In conjunction with Sir GEORGE KING he wrote "*Materials for a Flora of the Malay Peninsula*" and "*Flora of the Madras Presidency*" which, owing to the death of the Author, have not yet been published JAMES SYKES GAMBLE was appointed to the Forest School of Oxford as lecturer on Indian Forestry.

408 Dr ARTHUR GEORGI, successor to the well known editor PAUL PAREY, Berlin, has celebrated his twentyfifth year of editorial activity directed principally in support of agricultural and veterinary sciences For his many merits the Higher Agricultural School of Berlin appointed him, in May 1925, on the occasion of his 60th birthday, *doctor honoris causa* in agriculture. The publisher's catalogue of the firm of PAREY contains an extraordinary number of works and reviews dealing with these sciences Besides the former well known *Forstwissenschaftliches Centralblatt*, the following papers have been founded by the activity of Dr GEORGI "The Brewer's Journal" (*Tageszeitung fur Brauerei*), "The horticultural world" (*Gartenwelt*), "Agricultural Machinery" (*Landmaschinen*), "Review of applied entomology" (*Zeitschrift fur angewandte Entomologie*); "Zootechnical Review" (*Zeitschrift fur Tierzuchtung*), "Review of agricultural and irrigation legislation" (*Zeitschrift fur Agrar- und Wasserrecht*) and many others The Prussian Ministry of Agriculture has for a number of years employed this Firm for its official publications, whilst, owing to the extraordinary activity of Dr GEORGI, this Firm edits also for the *German Agricultural Society* the *Institute of Fermenting Industries*. the *Government Biological Institute for Agriculture and Sylviculture*, the *German Agricultural Council* the *Prussian Agricultural Chambers*, etc etc

409. On the 31st January last, German potash industry lost one of its most important exponents by the death of PAUL ALFRED GRAESSNER, ex adviser to the Ministry of National Economy

410 ROBERT M GREY, Superintendent of the Botanical Gardens, Cuba, the Howard Institute for Tropical Biology and Medicine, has been awarded the commemorative MEYER medal by the American Association of Genetics, for having introduced and cultivated in Cuba new varieties of sugarcane

411. Sir JOHN HARRISON, who died on the 9th February last, took a very prominent part in the scientific and agricultural development in the West Indies and Guiana. In 1879 he was appointed professor of Chemistry and Agriculture at Barbados and since 1905 he occupied the post of Director of scientific agriculture in British Guiana

412. G. W. HERVEY of the Rutgers University has been appointed biometer at the United States Bureau of Dairying for the purpose of collaborating

in the research of the laws governing heredity in the special functional aptitude of dairy cows.

413. The well known English authority on systematic botany, W. P. HIERN, F. R. S., died in his 85th year.

414. Prof. A. S. HITCHCOCK, curator of the U. S. National Herbarium, has been elected correspondent member of the German Botanical Society.

415. The death is announced of Dr. W D. HUNTER, senior entomologist of the U. S. Bureau of Entomology and member of the Federal Horticultural Board.

416. Dr. HANS OSCAR JUEL, Professor of Botany at the Upsala University, and Dr. SVANTE MARBECK, director of the Botanical Gardens, Lund, Sweden, have been elected foreign members of the Prussian Academy of Science.

417. Prof. JEAN LUTOSLAWSKI, sub-editor of the *Gazeta Polnicza* and member of the Board of Directors of the " Union of the Agricultural Organisations of Poland " has been decorated with the Order of " Redeemed Poland " for his services in the development of national agriculture.

418. The Wm. Y. NICHOLS medal has been conferred by the New York Section of the American Chemical Society on Dr S. C. LIND, one of the Directors of the Fixed Nitrogen Research Laboratory of Washington for his publication on the chemical action of the *alpha* particles

419. J. H. MAIDEN, F. R. S , ex director of the Sydney Botanical Gardens, died at the age of 67 years

420. JULES MELINE, ex Prime Minister and many times Minister in France, died in his 87th year He was a great supporter of protection for French agriculture and author of several publications amongst which " *Le Retour à la terre et la surproduction industrielle* " It is due to him that the order of the " *Mérite Agricole* ", was founded

421. Dr. V. H OUSSIMENKO, Veterinary Officer and Bacteriologist of the Island of MAUI in the territory of Hawaii, while experimenting in his own laboratory with haematic anthrax became inoculated with the infection and and succumbed to anthrax on 13 January last.

422. A PARMENTIER, who is generally considered to be the founder of the celebrated Botanic Garden at Brooklyn (New York) in 1825, was commemorated in October last by the unveiling of a bronze tablet in this garden. However, as is remarked by C. STUART GAGER in *Science* (Volume XLII, No. 1612, 1925), Parmentier had established a nursery garden in the locality about a mile away from the present Brooklyn Garden which is now entirely built over. Moreover, although the old horticulturist had at the time given the name of the *Brooklyn Horticultural and Botanic Garden* to his establishment, there was no connection, either historical or otherwise, which could justify regarding the nursery garden of 1825 as the first nucleus of the foundation of the present celebrated Institute of Brooklyn Botanical Gardens, and in fact the installation of these gardens was mainly due on the contrary to the late ALFRED T. WHITE.

423. Sylviculture has lost one of its best known devotees in the death of PHILIBERT ROTH, emeritus professor of sylviculture at the University of Michigan.

424. Sir WILLIAM SCHLICK, K. C. I. E., F. R. S., German by birth and by education as he was born in the Grand Duchy of Hesse Darmstadt and took his degree at Giessen, Inspector General of Forests in India, died last September at the age of 85. He had served first in the Province of Burma as an official of the Indian Forest Department and then in Scinde, in Bengal and in the Punjab. In 1885 he was summoned to England to take up the professorship of Sylviculture (Royal Indian Engineering College, Cooper's Hill). On the closing down of this Institute in 1905 Professor SCHLICK was transferred to Oxford. His best known work is a Manual of Forestry in five volumes.

425. The National Association of Electrical Industries (L'Associazione Nazionale Industrie Elettriche) in Italy is taking steps to commemorate in a worthy manner the centenary of the death of ALESSANDRO VOLTA which took place in Como on the 5th March 1827.

426. Professor HENRY WATERS, President of the Kansas State Agricultural College from 1909 to 1917 and well known for his works on animal nutrition, died in October last at the age of 60.

427. The ornithologist and lawyer LEVIS B WOODRUFF of New York has left his property to the Yale University for the benefit of the Museum A permanent bequest of 10,000 dollars must however be set apart for the New York Entomological Society The scientific collections and the natural history specimens belonging to the deceased have been passed to the American Museum of Natural History (*Science*, Vol LXII, No. 1617, 1925).

428. Professor B. WUNDER, formerly director of the Seed Selection Station for the Berlin Agricultural Domain, has been appointed director of the *Estación Experimental de la Sociedad National de Agricultura* of Santiago, in Chile.

429. The Society of American Bacteriologists have elected the foreign corresponding members: WINOGRADSKY (Russia and France), BEIJERINCK (Holland); OMELIANSKY (Russia); NEUFELD (Germany); KITASATO (Japan).

Dott. G. A. R. BORGHESANI, *direttore responsabile*.